TISCIA

Vol. XVIII

ADJUVANTIBUS

I. BANCSI, I. FODOR, I. KISS, M. MARIÁN, L. MÓCZÁR,

M. OBRADOVIĆ

REDIGIT

GY. BODROGKÖZY

Index

SZEGED, 1983

TISCIA

Vol. XVIII

DISSERTATIONES BIOLOGIAE A COLLEGIO EXPLORATORUM
FLUMINIS TISCIAE EDITAE

ADJUVANTIBUS

I. BANCSI, I. FODOR, I. KISS, M. MARIÁN, L. MÓCZÁR,

M. OBRADOVIĆ

REDIGIT

GY. BODROGKÖZY

SZEGED, 1983

ISSN 0563—586 X

Tiscia (Szeged) Vol. XVIII, pp. 3—8 (1983)

EFFECT OF IRRIGATION WATER POLLUTED WITH DIFFERENT CHEMICALS ON CULTIVATED PLANTS I. WEED KILLING EFFECT OF CHLORBROMURON AND THAT OF HERBICIDES MIXTURES ON SPECIES GRAMINEAE

JULIANNA SZÉLL, IBOLYA K. BALOGH and MÁRIA H. MÉSZÁROS

Attila József University, Szeged
(Received September 8, 1981)

Abstract

Examinations were carried out by pre- and postemergent treating of barley, rye and oat seedlings with chlorbromuron and herbicides mixtures. These control plants were also used in field experiments carried out in culture pots. The concentration of agents was to show the possible pollution of natural and irrigation waters. Different development of seedlings was observed and owing to the field experiments carried out in culture pots the agents' period of effectiveness could have been established as well.

Introduction

The third main thesis of the economy of water-supply is irrigation, estimated watermass of which is goind to be 2.7—3.7 milliard m^3 by 1985. Estimated watermass of fishing ponds is going to be 0.8 milliard m^3 by then. This is the very water-quantity, the slowly-decomposing organic compound pollution of which is to be minimised. Irrigation and chemical weed-killing are connected by running water and system of canalisation from the view-point of canalisation. At chemical weed-killing preventation has special importance, being necessary in a given period of cultivation and followed sometimes by disadvantageous water-supply factors.

Preemergent utilisation of weed-killers concides with the time of seeds' sowing or planting. Treatment of plants on different stages of development is known as the herbisides' postemergent utilisation which can be repeated several times within a cultivation period. Their utilisation of non-convenient concentration washing-out of the soil followed by the weeds' devastating effect may cause significant damages in the cultivated-stand of other territories. Our examinations were carried out with chlorbromuron and weed-killing mixture. These agents' effect on barley, rye and oat seedlings was examined in pre- and postemergent treatments. The same species were used in our field-experiments as well. During laboratory examinations except for the plants' development-parameters was determined the total soluble protein content and was measured the peroxidase enzyme-activity, which is a sensitive signal for damage. Agents' life-span of efficacy was established on the basis of culture-pot experiments.

Materials and Methods

Germination was carried out on 23°C in dark in breeding solution containing agents — at preemergent treatment. Tap-water control plants and the treated ones were grown among the same circumstances. At postemergent treatment 4-day-old seedlings were moved from dark into a light-thermostat (about 700 lux) and during their further growth a 14 hour light-period was changed with 8-hour dark one. Plant-physiological changes were observed by following some parameters, so the control plants' soluble protein content could be decided according to LOWRY at al. (1951), and their peroxidase enzyme activity by COLOWICK's and KAPLAN's method (1955).

During field experiments in culture pots herbicides (0.5 g clorbromuron and 3 ml/l herbicides mictures) were carried during sowing preemergently and postemergently on diplyllouse. Experiments were repeated 3—5 times.

Results and discussion

Effect of preemergently used clorbromuron on barley, rye and oat seedlings.

Preemergent treatment was examined on the 5th day of germination carried out in dark. 2 mg/l and 4 mg/l concentration of clorbromuron or its 5 times more amount were established not to inhibit the seddlings' development, even slightly prometed the root's and stem's growth in length at all the three control plants (Table 1).

Table 1. *Effect of preemergently used clorbromuron treatment on the growth of 5-day-old seedlings and on the dry-material content of plants*

Sortes	Agent's concentration	Length in mm. shoot	root	Dry-material content in % shoot	root
Barley	2 mg/l	77	122	7.57	7.7
	4 mg/l	80	116	7.52	7.3
	10 mg/l	84	128	7.57	6.35
	20 mg/l	86	125	7.95	6.85
	control	73	118	7.3	7.22
Rye	2 mg/l	67	106	9.05	10.4
	4 mg/l	65	90	9.4	8.2
	10 mg/l	70	119	8.12	7.3
	20 mg/l	68	117	8.2	6.85
	control	65	112	8.48	6.9
Oat	2 mg/l	52	73	7.1	5.58
	4 mg/l	58	80	6.72	5.75
	10 mg/l	55	79	7.75	8.5
	20 mg/l	56	70	7.02	7.0
	control	54	72	7.4	6.8

When examining the dry-material content, lower concentrations of clorbromuron resulted higher values in the root and shoot of the control-plant. At higher concentrations dry-material contents were under the control values. Examining peroxidase enzyme activity of the first leaf's level, values differed from the control ones in the shoot's development (Table 2).

Table 2. *Effect of clorbromuron treatment on the peroxidase enzyme activity of the first leaf's level of the 5-day-old seedling*

Sortes	Agent's concentration	Peroxidase enzyme activity EU*g* fresh weight
Barley	10 mg/l	181
	20 mg/l	161
	control	175
Rye	10 mg/l	126
	20 mg/l	157
	control	177
Oat	10 mg/l	127
	20 mg/l	125
	control	141

After the tratment rye and oat showed a decrease in enzyme-activity. The barley's reactivity is much the same with that of the rye according to the control values. Neverthless the two species showed a different reaction after the treatment; at lower concentration the barley's activity increased, while that of the rye and oat positively decreased. Urea-type herbicides have a good transportation in the plant, their degradation and transformation may occure, their effect on peroxidases is secondary, but shows the whole metabolism's involvment. Effect of preemergently used weed-killing mixture on barley, rye and oat seddlings.

The preemergently used weed-killing mixture inhibited the shoot's and root's development of barley-seedlings in comparison with the control ones. When determining the peroxidase-activity of 5-day-old barley seedling's first leaf-level, increase could be observed in comparison with the control. There was no significant difference in the plant's ascorbic-acid content. The tratment had an inhibitory effect on the growth of rye -seedlings. The peroxidase, activity and ascorbic-acid content increased as well. In the case of oat seedlings the effect on the plant's condition and dry-material content was similar to that of the two other controls. Decrease of peroxydase-activity and ascorbic-acid content in this case was the most expressed (Table 3).

Effect of postemergent treatments; Barley, postemergently treated with weed-killing mixture didn't show any divergence in growth and development as compared to the control-plant. Values of dry-material accumulation and peroxidase-activity hardly changed. Owing to the fast metabolism the quantity of ascorbic-acid increased in comparison with the plants treated with lower concentration. Weed-killing effect of the mixture with 2.5 ml/l concentration was similar to that of untreated control ones

As an effect of postemergent treatment 10-day-old rye-plants were significantly damaged. Leaves had started to dry and the plants died soon. The quantity of ascorbicd-acid increased in the case of examined concentrations. Activity of peroxidase-enzyme increased by 50% when being treated with higher concentration.

The mixture's weed-killing effect was well-tolerated by oat-plants. The shoot-growth of 15-day-old plants was only slightly inhibited. There were no significant changes in the peroxidase enzym activity and in the quantity of ascorbic-acid. The results of experiments are shown in Table 4.

Table 3. *Data of Gramineae species preemergently treated with weed-killing mixture and germinated in dark*

Sortes	Agent's concentration	Shoot: Length in mm	Shoot: Dry-mate-rial in %	Shoot: AA γ/g fresh weight	Shoot: PO EU/g fresh weight	Root: Length in mm	Root: Dry-mate-rial in %	Root: AA γ/g fresh weight	Root: PO EU/g fresh weight
Barley		71	7.86	207	126	78	9.37	—	—
Rye	5 ml/l	64	9.4	308	208	56	15.00	—	—
Oat		149	6.5	347	244	48	6.8	—	—
Barley		67	7.95	203	137	82	7.76	—	186
Rye	10 ml/l	71	10.00	381	251	70	14.70	—	236
Oat		135	5.1	314	259	54	6.3	—	240
Barley		87	7.4	211	123	117	6.23	—	195
Rye	control	92	9.3	364	249	108	6.4	—	197
Oat		196	4.4	371	316	106	6.1	—	161

Table 4. *Data of cereals postemergently treated with herbicides-mixtures*

Sortes	Agent's concentra-tion	Length in mm	Shoot and first leaf's level: Dry mate-rial in %	AA γ/g fresh weight	PO EU/g fresh weight
Barley 10-day-old	5 ml/l	104	10.78	441	120
	2.5 ml/l	115	9.98	279	142
	control	139	9.56	301	153
Rye 10-day-old	5 ml/l	96	10.00	396	412
	2.5 ml/l	96	10.2	465	481
	control	113	9.7	336	451

Account of field-experiments in culture-pots; Plants of field-experiments were given only natural precipitation after herbicide-treatment. Barley-plants had germinated but by the 23th day after the preemergent treatment died. Similar results were obtained by postemergent treatment with chlorbromuron. Pre- and postemergent treatment with clorbromuron. Pre- and postemergent treatments were even less tolerated by rye and oat and these plants died as well.

Culture-post were used repeatedly after dying till we could get plants of the same condition as the control ones. In this way it could have been established that the effect of chlorbromuron had been unchaged until the 62nd day after the treatment.

The weed-killing mixture's effect on the Gramineae control-plants was similar to that of the chlorbromuron, while our experiments with other herbicides, for example using 2,4-dichloro-phenoxy-acetic-acid, healthy-developing plants were produced on the 20—23rd days after treatment.

* * *

The 3-(3-chlor-4-bromfenil)-1-metoxi-1-metilurea, the so-called chlorbromuron's effect was examined on different cereals. Urea-type herbicids showed divergent fitotoxic effect on each species during postemergent treatments. Results of preemergent treatments and culture-pot field experiments even during germination noted different chemical-reactivity. The same effect was observed by WESSEL and VAN DER VEEN (1956) when demonstrated the leaf's early loss of ability of binding carbon-dioxide after the treatment with urea-type chemicals.

Flavonmononucleotid is able to defeat the material's disconnecting role within fotosystem. This later interaction provides possibility for experiments to establish the level of detoxication within plant (SWEELSER 1963).

Further, as continuation of field-experiments, having known the herbicides' time of decomposition, minimising of disinfectant spray is aimed — which is important from environmental and economical view-points — as it has been done in the case of some cereals and herbicides (SCHALLER 1977, EGGER at al. 1978).

Experiments on utilization of weed-killing mixture have pioneer character.

We are grateful for the financial supoort under grant number 50—15—26—79 to the Ministry of Public Education and Hungarian Academy of Sciences.

References

EGGER, E., MASCARIN, P., LEMMI, M., CIMENTI, G. and MARCON, M. E. (1978): Rivista di viti calture e di Cenologia 31 (5) 195—217.

COLOWICK, S. P. and KAPLAN, N. O. (1955): Methods in enzymology. Vol. 2, 764. Academic press New York.

LOWRY, O. H., ROSENBROUGH, N. J., FARR, A. L. and RANDALL, R. (1951): J. Biol. Chem. 193, 265—275.

SCHALER, H. (1977): Nachibl. Pflschutz DDR. Berlin, 31. 5. 98—104.

SWEELSER, P. B. (1963): Biochim. Biophys. Acta 66, 78.

WESSELS, J. S. C. and VAN DER VEEN, R. (1956): Biochim. Biophys. Acta 19, 548.

Különböző anyagokkal terhelt öntözővíz hatása termesztett növényekre.

I. A klór-brómuron és a keverék gyomirtó hatása a Gramineae fajokra

SZÉLL JULIANNA, K. BALOGH IBOLYA és H. MÉSZÁROS MÁRIA

József Attila Tudományegyetem, Szeged, Magyarország

Kivonat

A 3-(3-klór-4-brómfenil)-1-metoxi-1-metilurea, röviden a klórbrómuron hatását vizsgáltuk gabona fajokon. Az urea típusú herbicidek fajonként eltérő fitotoxikus hatását tapasztaltuk a posztemergens kezelések során. A preemergens kezelések és a szabadföldi tenyészedényes kísérletek eredményei a már csírázáskor jelentkező eltérő vegyszerérzékenységre hívták fel a figyelmet. Eredményeinkkel egyező hatást figyeltek meg Wessel és Van der Veen (1956), amikor rámutattak arra, hogy a levél már igen hamar veszít a széndioxid megkötő képességéből az urea típusú vegyszerekkel történő kezelést követően. A fotoszisztémen belüli szétkapcsoló szerepet az anyagnak a flavinmononukleotid kivédeni képes. Ez utóbbi kölcsönhatás alapján kísérletek állíthatók be a növényen belül történő detoxikáció mértékének a megállapítésára (SWEELSER, 1963). Kísérleteink ily irányban történő folytatását tervezzük.

Uticaj navodnjavanja na gajene kulture različitim materijama opterećenom vodom

I. Uticaj klor-bromurona i herbicida na Gramineae

SZÉLL JULIANNA, K. BALOGH IBOLYA i H. MÉSZÁROS MÁRIA

JATE, Szeged, Hungaria

Abstrakt

Autori su uticaj klor-bromurona (3-(3-klor-4-bromfenil)-1-metoxil-1-metilurea) izučavali na žitaricama. Konstatovano je selektivno fitotoksično dejstvo nakon postemergentne primene herbicida na bazi uree. Preemergentna tretiranja kao i rezultati eksperimenata u sudovima gajenih biljaka u prirodnim uslovima, pokazali su selektivnu osetljivost već pri klijanju. Ovi rezultati se podudaraju sa postignutim efektima WESSEL-a i VAN DER VEEN-a (1956), koji su ukazali na činjenicu da listovi veoma brzo gube moć vezivanja CO_2 nakon tretiranja herbicidima na bazi uree. Flavinmononukleotid je u stanju da spreči ulogu razdvajanja materija unutar fotosistema. Na osnovu ove uzajamne uslovljenosti moguće je u samoj biljci utvrditi stepen detoksikacije eksperimentalnim putem (SWEELSER, 1963). Naša dalja istraživanja predvidjena su u ovom pravcu.

ВЛИЯНИЕ ЗАГРЯЗНЕННЫХ ПОЛИВНЫХ ВОД НАГРУЖЕННЫХ РАЗЛИЧНЫМИ ВЕЩЕСТВАМИ НА ВЫРАЩИВАЕМЫЕ РАСТЕНИЯ. II ВЛИЯНИЯ МОТОРНОГО МАСЛА И ДРУГИХ СОЛЕЙ 2,4-Д НАТРИЯ

Ю. Киш, К. Фюгеди и М. Горват

Университет им. Йожефа Аттилы, Сегед, ВНР

Резюме

В опытах преемергентным способом использовали одновременно 2,4-Д натриевую соль с моторным маслом для выращивания ячменя, тыквы и огурцов. Установили, действие разлинных способов на процесс прорастания семян у однодольных и двухдольных растений.

Масло влияет на процесс проростания семян, — вода проникает через семядоли не задерживается маслом, в результате, чего, семя набухает, причем 2,4-Д основной гербицид- как гормоновлиятельное вещество задерживает развитие зародыша и производит определенные изменения.

Увеличенный обьем аскорбиновой кислоты постепенная активизация пероксида, указывают на ускорение обмена веществ, что особо проявляется у тыквы.

У огурцов, проявление ранных поврежденний указывает на неспособность содержания изменений фенола. У сильно поврежденных растений редко увеличивается количество аскорбиновой кислоты.

У зародышей огурцов, это влияние в ранних стадиях еще не проявляется, но у 7-дневных поростков зародышей тыквы изменение уже ясно проявилось (Селл 1980).

В семействе злаковых морфологические и структурные изменения в прорастании семян очень подобные. Вес свежего эмбриона увеличится на 120% в истечении 20—30 минут после приема воды (Маркуш 1966). Итак стало ясно, что вредное влияние моторного масла уже проявляется при первых шагах проростания семян.

Tiscia (Szeged) Vol. XVIII, pp. 9—12 (1983)

EFFECT OF IRRIGATION WATER POLLUTED WITH DIFFERENT CHEMICALS ON CULTIVATED PLANTS

II. EFFECT OF MOTOR-OIL AND SODIUM-SALT OF 2,4-D

JUDIT KISS, KLÁRA K. FÜGEDI and MÁRIA H. MÉSZÁROS

University Attila József
(Received September 20, 1981)

Abstract

In our experiments monocotyledons and dicotyledons were treated preemergently with motor-oil and sodium-salt of dichloro-phenoxyacetic acid among laboratory circumstances. Present paper is the continuation of earlier papers (HORVÁTH and TAN VAN LE 1967, HORVÁTH and KERESZTES 1977, HORVÁTH and BALOGH 1979) performed with herbicide containing Dikonirt containing 2,4-D; pursuing the same hormonal agent's study influenced by a specially effective external factor, the motor-oil.

Introduction

Irrigation is spreading in our big horticultural and agricultural farms. Mechanical weed-killing has gone into liquidation in large-scale farming almost totally — mostly because of the lack of labour-force — and the same tendency is characteristic for horticulture. During cultivation water-consumption is changing, in summer and spring this branch of agriculture requires water in greater quantity as well.

In summer irrigation period motor-oil contamination of 10 mg/l often was measured on the lower reach of river Tisza during the recent years. The river's system of canalisation irrigates cultures of pea, vegetables, sugar-beet, onion, flax rice and maize where weed-killing is performed with herbicides. Motor-oil floating on the water surface changes its healthy oxygensupply and supports anaerob processes. This effect can be increased by the herbicids' washing out of the soil, which can cause the occurence of a modern problem, as a small quantity of hormon-type herbicides may have an enormous effect.

Materials and Methods

In preliminary experiments more species were included, of which were chosen MFB barley hybrid, asparagus pumpkin without trailer and delicate clustered cucumber of Kecskemét with the most characteristic changes. Seeds were germinated in thermostat at 23°C in dark. When controling, humidily of filter-paper was provided by tap-water, that of treated samples with 2,4-D sodiumsalt in 1, 2, 4 mg/l concentration + motor oil 2 ml/l. Systems of evaluation coincide with those of the previous paper. Experiments were repeated 3—5 times.

Results and discussion

Treatment didn't block the germination of barley seedling, their development could be interrupted by the joint effect of motor-oil concentration of 10 ml/l and agent 2,4-D of 2 mg/l. In this case the growth of root was blocked almost completely, the length of shoot decreased by half.

The germination of asparagus pumpkin was completely blocked by the above-mentioned treatment. Decreasing the agents' quantity by half, t.e. treating with motor-oil of 5 ml/l and 2,4-D of 1 ml/l the asparagus pumpkin germinated too. The length of shoot was 1.6 mm that of the root was 0.8 mm in the case of seven-day-old plant. By this time the shoot and root length of control seedlings has exceeded 4 m.m

Cucumber was the most sensitively reactive plant to the effect of motor-oil and herbicide. Development of delicate clustered cucumber of Kecskemét was interrupted completely by preemergent dosing of 2 ml/l oil and 1 mg/l 2,4-D; soon after the seeds' germination seedlings died. Parameters of test-plants diverging sensibility are shown in Table 1.

Table 1. *Effect of motor-oil and sodium-salt 2,4-D on seedlings treated preemergently*

Test-plants	Treatment	Length of shoot in mm	Length of root in mm	Peroxidase activity EU/g fresh weight
Barley				
6-day-old	10 ml/l oil+2 mg/l 2,4-D	57.3	4.7	58.9
	control	115.5	135.7	55.6
Asparagus pumpkin				
7-day-old	5 ml/l oil+1 mg/l 2,4-D	1.6	0.8	43.2
	control	4.1	4.4	22.4
Cucumber				
3-day-old	2 ml/l oil+1 mg/l 2,4-D	6.3	14.2	33.00
	control	33.7	59.2	28.2

The second part of our experiments aimed the detailed plant-physiological examination of the cucumber seedlings. We measured the ascorbic-acid content and total fenol quantity of the control and treated plants.

As a result of treatment a sudden rise of total fenol quantity was expected, but deviation couldn't have been measured by the change of fenol quantity at the preemergently treated three-day-old cucumber, though the soluble protein content increased significantly.

Table 2. *Examination of preemergently-treated cucumber seedlings*

Treatment	PO activity EU/g fresh weight	AA γ/g fresh weight	Total fenol content γ/g fresh weight	Total soluble protein mg/g fresh weight
2 ml/l oil+2 mg/l 2,4-D	32.6	158.00	181.00	206.00
control	28.2	150.00	180.00	150.00

Barley, asparagus pumpkin and cucumber test-plants were treated preemergently in our experiments with 2,4-D sodium-salt and motor-oil. Treatment has been established to influence the process of germination diversely in the case of monocotyledons and dicotyledons.

Oil effected the necessary for germination water-absorption processes, while herbicides 2,4-D effecting as hormones — cause changes in the plant-physiological processes of germination. The increased ascorbic-acid quantity and the increasing peroxidase activity mark the increasing oxidative dissimilation (decomposing metabolism). This was most strikingly expressed in the case of asparagus pumpkin. In the case of cucumber the change of total fenol-content is not suitable for the early signaling of damage.

In the badly-damaged plants the quantity of ascorbic-acid has suddenly increased. In the case of three-day-old cucumber seedling this effect couldn't be noticed at this early stage of development but the change was detectable in the case of seven-day-old asparagus pumpkin seedlings (Széll 1980). Morphological and structural changes of the Gramineae families' germinating seeds are very similar. The embryo's fresh weight increases by 120% 20—30 minutes after the water-assimilation. (Marcus 1966). This explains the oil's radical damaging effect on the first stage of germination.

The different 2,4-D sensibility of dicotyledons is connected with the role of cotyledon and with the late appearence if foliage-leaf, while that of monocotyledons is connected with the effect on the mobilisation of seed's reserves.

References

Horváth, M. M. and Tran Van Le (1976): Acta Biol. Szeged, *22*, 79—81.

Horváth, M. M. and Keresztes, T. (1977): Acta Biol. Szeged, *23*, 73—81.

Horváth, M. M. and Balogh, I. (1979): Summary of a lecture delivered al the Xth Tisza-Research Conference. — Szeged, 20—21 April.

Lowell, P. and Moore, K. (1971): J. of Exp. Bot. *22*, 154—162.

Marcus, A., Feely, I. and Volcani, T. (1966): Plant Physiol. *41*, 1167.

Széll, J. (1980): Ph. D. thesis, Szeged.

Különböző anyagokkal terhelt öntözővíz hatása termesztett növényekre

II. Motorolja és 2,4-D nátrium sójának hatása

Kiss Judit, K. Fügedi Klára és H. Mészáros Mária

József Attila Tudományegyetem, Szeged, Magyarország

Kivonat

Kísérleteinkben preemergens kezelésben a 2,4-D nátriumsóját és a motorolajat együttesen alkalmaztuk árpa, spárgatök és uborka tesztnövények felhasználásával. Megállapítottuk, hogy a kezelés a csírázás folyamatát eltérő módon befolyásolta az egyszikű és kétszikű növényeknél.

Az olaj a csírázás folyamatához nélkülözhetetlen vízfelvételi folyamatokon keresztül fejti ki hatását, míg a 2,4-D alapú herbicid, mint hormonhatású anyag a csírázás növényélettani folyamataiban okoz változásokat.

A megnövekedett aszkorbinsav mennyiség és a fokozódó peroxidáz aktivitás az oxidatív leboontó anyagcsere térnyerését jelzi. Ez a spárgatöknél volt a legkifejezettebb. Uborkánál a károsodás korai jelzésére az összfenol tartalom változása nem alkalmas. Az erősen károsodó növé-

nyekben az aszkorbinsav mennyisége hirtelen gyarapodást mutat. A három napos csíranövénynél, így az uborkánál még ez a hatás a korai időszakban nem jelentkezett, de a 7 napos spárgatök csíranövényeknél már megállapítható volt a változás (SZÉLL 1980).

A Gramoneae családban a csírázó magvak morfológiai és szerkezetbeli változásai igen hasonlóak. Az embrió friss súlya 120%-kal nő a vízfelvételt követő 20—30 perc elteltével (MARCUS 1966). Így érthető, hogy az olaj károsító hatása már a csírázás első lépésébe nagyon radikálisan avatkozhat be.

Uticaj navodnjavanja na gajene kulture različitim materijama opterećenom vodom

II. Uticaj motornog ulja i 2,4-D natrijumovih soli

KISS JUDIT, K. FÜGEDI KLÁRA i H. MÉSZÁROS MÁRIA
JATE, Szeged, Hungaria

Abstrakt

U našim eksperimentima sa preemergentnom primenom zajedno smo tretirali 2,4-D natrijumovu so i motorno ulje na ječam, bundevu i krastavac. Utvrdjeno je da ovo tretiranje različito utiče na proces klijanja monokotila i dikotila.

Ulje svoje dejstvo ispoljava preko prijema vode, neophodnog procesa za klijanje, dok herbicid na bazi 2,4-D, usled svog hormonalnog dejstva izaziva promene u fiziologiji klijanja.

Povećana količina askorbinske kiselina i tendencija povećavanja peroksidazne aktivnosti ukazuje na razlagajuće oksidativne procese u razmeni materija. Ovo je najizrazitije kod bundeve. Za rano utvrdjivanje oštećenja u slučaju krastavca promena ukupne količine fenola nihe pogodna. U biljaka sa jakim oštećenjima količina askorbinske kiseline pokazuje naglo povećavanje. U trodnevnih klijanaca bundeve već su se ukazale promene (SZÉLL 1980).

Morfološke i strukturalne promene u naklijalim semenkama Gramineae su veoma slične. Sveža težina embriona se u roku od 20—30 minuta povećava za 120% nakon uzimanja vode (MARCUS 1966). Sasvim je očigledno da se štetno dejstvo ulja radikalno pojavljuje već u prvim trenucima klijanja.

ВЛИЯНИЕ ПОЛИВНЫХ ВОД, НАГРУЖЕННЫХ РАЗЛИЧНЫМИ ВЕЩЕСТВАМИ, НА ВЫРАЩИВАЕМЫЕ РАСТЕНИЯ I. ВЛИЯНИЕ ХЛОР-БРОМУРОНА И ИХ СМЕСИ КАК СРЕДСТВА ДЛЯ УНИЧТОЖЕНИЯ СОРНЯКОВ ЭЛАКОВЫХ КУЛЬТУР

Ю. Селл, К. Балог, И. и М. Горват
Университет им. Йожефа Аттилы, Сегед, ВНР

Резюме

Нами исследовано влияние 3-(13-хлор-4 бромфенил)-I-метокси-I-метилуреа: сокращенно хлор-бромурон, на хлебные культуры. При постемергентных исследованиях, определилось фототоксическое влияние гербицида уреа на различные хлебные культуры. Результаты опытов проведеных свободно на полях в опытных горшках, обратили внимание на различную чувствительность проростающих семян к химикатам.

Те же результаты получили также Вессел (WASEL) и Вандер Веен (VAN DER WEEM) (1956) когда указали на то, что листья при использовании химического соединения уреа гораздо быстрее теряют углекислый газ. Внутри фотосистемы разложение веществ может защитить флавинтононуклеитид. На основании высшесказанных вазимодействий внутри растений можно провести опыт для установления меры детоксикации (Швеелсер, SWEELSER 1963). В этом направлении ми Прешили продолжать эксперименты, а также свободнопочвенные эксперименты зная время распада гербицидов с точки зрения сельського хозяйства и окружающей среды,

Tiscia (Szeged) Vol. XVIII, pp. 13—21 (1983)

COMMUNAL HYGIENIC AND BACTERIOLOGICAL CONDITIONS OF THE RIVER-BANK BATHS AONG SURFACE WATERS IN CSONGRÁD COUNTY

MÁRIA HEGEDÜS, IBOLYA LÉVAI, ZSÓFIA FODRÉ and MARGIT ZSIGÓ

Public Health Station of Csongrád County, Szeged, Hungary
(Received February 20, 1981)

Abstract

In 1979—1980 the authors have dealt at a high priority with the problem whether the river-bank baths established in Csongrád county along surface waters are actually suitable for the purposes of bathing and water sports in the summer season of their utilisation. On the basis of a complex survey it was found that the fundamental hygienic conditions of the recreation areas are satisfactory. At the same time also the most important further tasks were listed. The results of the bacteriological investigations of waters carried out in the season of utilisation are given in a Table indicating the sampling sites. In the water samples the occurrence of Salmonella bacteria further the amounts of the coliform end faecal coliform bacteria and their relative proportions were determined. These results were compared with the amounts of the water output of the investigated period. On the basis of the results of hygienic bacteriological investigations carried out in the seasons of utilisation of the mentioned two-year period attention is called to the fact that in Csongrád county only the water of the Tisza backwater at Mártély is suitable for the purposes of recreation and water sports.

Introduction

In Csongrád county about 450 000 residents are requiring adequate conditions for recreation and sporting. In the county the natural scenery and the greater rivers further the backwaters of the Tisza river offer possibilities of recreation to the residents. These possibilities can be utilised and according to the requirements care must be taken to their further development. The group for hygiene and the laboratory of the Department for Settlement Hygiene of the Public Health Station of Csongrád County (KÖJÁL) have dealt in 1979—1980 at a high priority with the problem whether in the summer season of utilisation the communal hygiene of the river-bank baths and recreation areas, further the bacteriological quality of the waters are suitable for the purposes of recreation, bathing and water sports. The hygienic bacteriological investigation of the surface waters is carried out regularly since 1975. The results of these investigations have been reported also in papers (HEGEDÜS 1979, 1980).

The Salmonella contamination of the Szeged reach of the Tisza was described already of HERNÁDI and ROSZTOCZY (1935).

Hygienic bacteriological investigations were carried out for five years by VETRÓ, KISS and MINDSZENTY (1966) in the Tisza-reach of Szeged city. It was found that though the value of the coliform count is unfavourable in the Tisza water at the sewage inflows, these inflows are not detrimental to the water quality of the sites licensed for bathing.

The hygienic microbiological investigation of the water of baths (beaches) established along the banks of the river Danube and of the Lake Balaton has been investigated by several authors. ULLRICH et al. (1977) investigated the water of beaches along the Ráckeve branch of the Danube and along the Danube-bend. They found that the quality of the water is unfavourable and detected regularly also pathogen bacteria. In order to establish the hygienic water quality of Lake Balaton a complex survey was carried out by SCHIEFNER et al. (1978). According to their report in this region of water "the deterioration of the hygienic bacteriological parameters expressible also by the classification of the water quality still did not take place".

In the period between 1975—1978 we found on the basis of the hygienic bacteriological investigations carried out by us (HEGEDÜS 1980) that the surface waters of the county were of a "contaminated" quality except for a few cases. Consequently it appeared to be of importance to examine whether our surface waters are suitable in the season of utilisation (about from May to end of August) for the purposes of bathing and water sports. The present study is a detailed report of this problem.

Materials and Methods

In Csongrád county the recreation areas, the beaches along surface waters have been developed in the flood-plain of the rivers Tisza, Hármas-Körös and Maros, further in the Tisza backwater at Mártély. From the aspect of the evaluation of the hygienic conditions priority was given to the investigation of the supply of drinking water, to the sewerage, to the collection of wastage and refuse, to the purity of the air, to the living plants and to the bacteriological quality of the surface waters. The hygienic bacteriological investigations were carried out according to the "Methodological Instructions" (1977) issued by the Department for Water Hygiene of the National Institute of Public Hygiene, and to the standard "Bacteriological Investigation of Drinking Water" (1971). The results were evaluated on taking into account the limit values of the Draft of Sectoral Standardization of the Ministry of Health and the National Office of Water Conservancy (1972).

Results

On the basis of the hygienic survey the supply with communal utilities is similar in all the recreational areas. The supply with drinking water is adequate, its quality has been controlled by the Public Health Station (KÖJÁL) of the county by regular samplings. The sewage disposal was at present everywhere inadequate. The sewer system is not established, the sewage lagoons located in the flood-plain do not operate adequately due to the high water level. Therefore during the floods the hazards of the contamination of the recreational areas are particularly existing. When the flood has passed, the arrangement, disinfection of the area and the renovation of the buildings are necessary in every case. The sewage disposal of the swimming boats on the Tisza river at Szeged is also objectionable since the formed sewage enters the Tisza directly below the boat, contaminating in this way the bathing area. The unreclaimed sewage of the city Szeged (about 70 000 m^3/day) is now polluting the Tisza reach below the city. Owing to the contamination of the river the Public Health Station (KÖJÁL) refused the permission to establish a beach in this reach. The collection of refuse and its transport is organized and regular in the recreational

Table 1. *Results of the bacteriological investigation of beaches established along surface waters*

Sampling site	Year of investigation	Coliform counts/ml average	Faecal coliform counts/ml values	Percentage of *Salmonella* positivity	Water qualification
TISZA river					
Csongrád beach	1979	286.66	24.13	44.44	IIIrd class
	1980	82.16	24.06	49.95	IIIrd class
Szentes beach	1979	858.00	164.66	25.00	IIIrd class
	1980	60.60	16.76	50.00	IIIrd class
Mindszent beach	1979	594.66	79.66	50.00	IIIrd class
	1980	31.72	22.30	42.85	IIIrd class
Szeged-Tápé beach	1979	215.90	47.23	25.00	IIIrd class
	1980	48.00	17.30	57.14	IIIrd class
Szeged beach and boats for swimming	1979	65.66	58.55	87.50	IIIrd class
	1980	113.60	36.00	44.10	IIIrd class
MAROS river					
Apátfalva beach	1979	—	—	33.30	—
	1980	94.00	17.50	60.00	IIIrd class
Makó beach	1979	321.60	74.18	54.54	IIIrd class
	1980	199.30	31.30	62.50	IIIrd class
BACKWATERS					
Csongrád Serházzug backwater	1979	160.00	92.00	**	IIIrd class
Kayaking area	1980	167.00	95.00	**	IIIrd class
Mártély backwater	1979	7.60	1.35	**	Ist class
beach	1980	7.90	0.78	**	Ist class

** *Salmonella*-negative = no bacteria belonging to the genus *Salmonella* could be cultivated from 1000 ml of the water sample.

areas. In the relaxation areas there are no air-polluting sources, they have been established far from industrial zones and busy streets, the forests and green belts have been developed adequately.

The quality of the surface waters of the county is reflected by the results of the bacteriological investigations reported in the followings.

In the utilisation seasons of the last two years (from about May to end of August) on the beaches of the surface waters of the county *Salmonella* tests were carried out in 169 samples and complex bacteriological investigations were performed in 66 water samples. The average values of the results and the percentages of *Salmonella* positivity are summarized in Table 1, in groups according to sampling sites.

On comparing the average values of the results of investigations during the mentioned two years it is apparent that very great differences exist between the values. In 1980 the average values of the coliform and faecal coliform counts/ml were lower by one order of magnitude than those observed in 1979 both at the sampling sites along the Tisza and at those along the Maros, excepting the coliform counts observed on the Szeged beach.

When observing the changes in the percentage of *Salmonella* positivity it can be stated that the percentage of positivity increased at the sampling sites Szentes, Tápé and Apátfalva whereas it decreased to about the half value at the Szeged Partfürdő site. Since the water output of the river Tisza is very varying and fluctuating, the data of the water output during the examined two years are shown in Fig. 1 indicating the sites and dates of sampling. (The values of water output were supplied

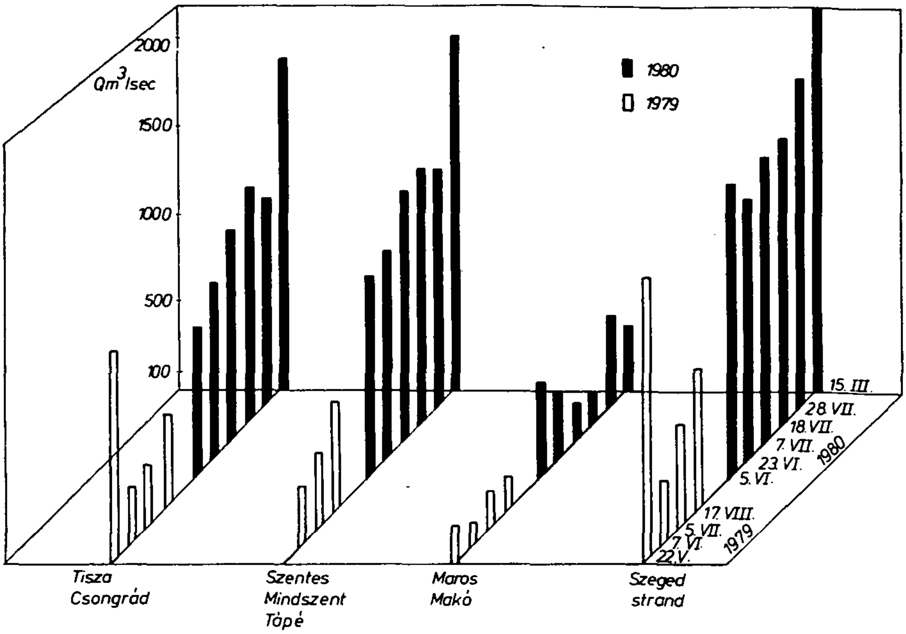


Fig. 1. Changes in the amount of the water output in 1979—1980.

by the workers of the firm ATIVIZIG and the authors express here their gratitude for this). It can be seen in Fig. 1 that the water outputs of the summer season of the mentioned two years differed significantly from each other both in case of the Tisza river and in that of the Maros river. The summer of 1979 was a "low-water" period in comparison to that in 1980 whereas in the latter year a high water output predominated. It is likely that the occurrence of the coliform and faecal coliform bacteria in a relatively smaller number may be attributed to the water output of the year 1980 which exceeded the average values. In 1979 in turn, at a lower output the average values of the coliform bacteria were higher by an order of magnitude and also the local polluting effects could be measured better (e.g. HEGEDŰS et al. (1980) at Mindszent). Furthermore it is known that in 1979 a significant sewage wave arriving from over the frontier passed through the river Tisza. It is likely that the effect of this wave has been recorded by us at some sampling sites (e.g. at Szentes and Tápé).

On surveying the hygienic bacteriological conditions of the beaches established along the river Maros it can be stated that the water was during the summer season of utilisation of a "contaminated" quality at both sampling sites. The values of the coliform and faecal coliform counts/ml were significantly affected also in this river by the differences between the water outputs of the two years discussed.

In Csongrád county two backwaters of the Tisza river are used for purposes of recreation and bathing. The waters of these backwaters can be considered as nearly stagnant waters, and this appears also in the high stability of the observed values. The Mártély backwater, quite in contrast to the Serházzug backwater, is directly connected with the river Tisza through a southern connecting channel. In the high-water periods of the Tisza, the water level rises also in the backwater, the floodplain is inundated and the recreational area as well. This process occurred end of

July 1980, as indicated by the coliform count 1600/ml and the faecal coliform count of 160/ml. Since at this time the water has not been utilised for purposes of recrea tion and bathing in the backwater, this value has been omitted on calculating the average value since it was not considered to be typical. When however this fact is considered from a hygienical aspect, it must be regarded as an important condition because during the rinsing of the sewage lagoons located in the recreational area the water of the backwater became contaminated to an extraordinary extent.

Since great differences appeared between the results of the summer seasons of the investigated two years, it seemed advisable to incestigate whether differences of similar magnitude are occurring also in the ratio of the coliform and faecal coliform bacteria. According to our calculations this ratio was 4.6 in 1979 and 3.8 in 1980. Thus, though in 1980 the values of the coliform counts and faecal coliform counts were lower, their ratio proved to be less favourable. Data based on this ratio concerning the entire Hungarian longitudinal section of river Tisza have been published by DEÁK and SCHIEFNER (1972), investigating also the ratios of these bacteria in the *Salmonella*-positive and *Salmonella*-negative samples.

We have carried out this calculation as well and our results are given in Table 2. In this relation it can be stated that no essential differences exist in case of the *Salmonella*-negative samples whereas in case of the positive samples a difference appeared

Table 2. *Proportion of counts of coliform bacteria to counts of faecal coliform bacteria*

Year of investigation	In *Salmonella*-positive samples	In *Salmonella*-negative samples
1979	5.80	3.56
1980	3.81	3.58

between the annual values. On the basis of our results it can be stated that in the surface waters of Csongrád county the number of coliform bacteria was in the examined period 4-6-times higher than the faecal coliform counts.

In the years 1979—1980 in the utilisation season investigations concerning the detection of bacteria belonging to the genus *Salmonella* were carried out in 169 water samples. Our results are summarized in Table 3. At the serotypization of *Salmonella* bacteria also several *Salmonella* colonies were investigated in the same water sample. When the water sample contained only identical serotypes, this was considered as solely one strain. This is the cause why differences appear between the values given in the Table 3 and those mentioned in the text.

During the two-year period, of the 65 *Salmonella*-positive water samples of 9 sampling sites, 165 *Salmonella* strains were serotypized which belonged to 23 serotypes. On evaluating the results separately for each sampling site it can be stated that the greatest number and the most diversified serotypes of *Salmonella* have been isolated from the Szeged reach of the Tisza and from the Makó reach of the Maros river. Bacteria belonging to the Salmonella genus could never be isolated from any of 1000 ml water samples of the backwaters Mártély and Serházzug withdrawn during the two-year period.

* * *

Table 3. *Serotypes and numbers of Salmonella strains isolated in the years 1979 and 1980 at the recorded sampling sites*

Salmonella serotypes	Sampling sites									
	TISZA					MAROS				
	Csongrád	Szentes	Mindszent	Tápé	Szeged*	Makó	Apátfalva	Serházzug backwater	Mártély backwater	TOTAL
1. S. derby	3	2	3	—	2	2	—	—	—	12
2. S. give	3	—	1	1	5	1	—	—	—	11
3. S. panama	3	2	1	4	1	—	—	—	—	11
4. S. typhimurium	1	—	—	—	2	4	1	—	—	8
5. S. agona	—	1	1	1	2	—	2	—	—	7
6. S. heidelberg	—	—	—	—	3	2	1	—	—	6
7. S. newport	—	—	—	—	3	2	—	—	—	5
8. S. bovismorbificans	—	—	1	—	2	1	—	—	—	4
9. *S. abortusbovis*	—	—	—	1	2	—	—	—	—	3
10. S. london	1	—	—	1	1	—	—	—	—	3
11. S. senftenberg var. newcastle	—	—	—	1	—	1	1	—	—	3
12. S. anatum	—	—	1	—	1	—	—	—	—	2
13. *S. aba*	—	—	—	—	—	—	1	—	—	1
14. S. bredeney	—	—	—	—	—	1	—	—	—	1
15. S. enteritidis	—	—	—	—	1	—	—	—	—	1
16. *S. essen*	—	—	—	—	—	1	—	—	—	1
17. *S. indiana*	—	1	—	—	—	—	—	—	—	1
18. S. infantis	—	—	—	—	1	—	—	—	—	1
19. S. java	1	—	—	—	—	—	—	—	—	1
20. *S. mbandaka*	—	—	—	—	—	1	—	—	—	1
21. S. reading	—	—	—	1	—	—	—	—	—	1
22. S. saintpaul	1	—	—	—	—	—	—	—	—	1
23. S. thompson	—	—	—	1	—	—	—	—	—	1
Total:	13	6	8	11	26	16	6	0	0	86

TISZA, Szeged (+) values refer to sampling sites: Riverbank beach, four boathouses for swimming and "free beach".

Underlined serotypes indicate serotypes isolated in Csongrád county for the first time.

The Department for Settlement Hygiene of the Public Health Station (KÖJÁL) of Csongrád county surveyed the health resorts and beaches with increased attention n 1979—1980. On the basis of the control tests it was found that:

1. the fundamental hygienic condition of the recreation areas and beaches is acceptable;
2. the development of the supply with communal utilities, with particular respect to sewage treatment and disposal, is very important in order to protect the surface waters from further contaminations;
3. the development of the correct human forms of attitude during recreation and bathing must be promoted;
4. in order to achieve the more cultured development of the investigated areas a more efficient coordination of the activity of the keepers, the operators, the social and mass organizations and of the authorities concerned is needed.

On the basis of the results of the bacteriological investigations the followings could be stated:

1. The water of the riverside beaches established along the Tisza and Maros ri vers, furthermore the water of the Tisza backwater at Serházzug are according to the hygienic bacteriological investigations IIIrd class water of "contaminated" iquality. According to the limit values being valid at present they are not suitable for recreational, bathing and water-sporting purposes.

2. A favourable water quality appeared only on the beach established along the Tisza backwater at Mártély, with the exception of the period when the recreational area has been flooded by the Tisza river.

3. On comparing the results of investigations carried out during the mentioned two years with the amount of the water outputs of the investigated period great differences were observed in the values of the coliform counts and faecal coliform counts but at the same time hardly any differences appeared in the proportion of both bacterium groups to each other.

4. No significant differences were found between the proportions of the two groups of bacteria in the case of *Salmonella*-negative samples, either, whereas in case of the *Salmonella*-positive samples this proportion disclosed a more favourable value.

On the basis of the hygienic bacteriological investigations carried out during the utilisation season of a two-year period attention ic called to the fact that in Csongrád county solely the water of the Tisza backwater at Mártély proved suitable for purposes of recreation and water sports.

References

DEÁK, Zs. and SCHIEFNER, K. (1975): Higiénés mikrobiológiai vizsgálatok a Tiszán és jelentősebb mellékfolyóin (Hygienic microbiological investigations in the Tisza and major tributaries). — Magy. Hig. Publ. of Itinerary Congr. Budapest *19*, 220—228.

DEÁK, Zs. and PÉNZES, M. (1973): A Duna egyes szakaszainak vízbakteriologiai jellemzése. különös tekintettel a szabad strandok higiénés megítélésére (Bacteriological characterization of the water of some reaches of the Danube, with special regard to the hygienic qualification of the swimming beaches). — Egészségtudomány *17*, 336—349. (in Hungarian). Ministry of Health — national Office of Water Conservancy (1972): Draft of the sectoral Standardization of the Quality Evaluation of Surface Waters. Budapest (in Hungarian).

HEGEDÜS, M., KISS, P. and BERÉNYI, L. (1979): Salmonellae in the surface waters of Csongrád county. — Tiscia (Szeged) *14*, 25—39.

HEGEDÜS, M., FODRÉ, Zs. and ZSIGÓ, M. (1980): Hygienic bacteriological investigations in the Tisza reaches between Csongrád and Szeged (1975—78). — Tiscia (Szeged) *15*, 35—44.

HERNÁDI, M. and ROSZTÓCZY, E. (1935): A Tisza és a Maros fertőzöttsége Szegeden (Contamination of the rivers Tisza and Maros at Szeged) (in Hungarian). — Népegészségügy *26*, 20.

Ivóvíz bakteriológiai vizsgálata (Bacteriological investigation of drinking water). — Hungarian standard MSZ 22 901—71 (in Hungarian).

Módszertani Útmutató a felszíni vizek higiénés bakteriológiai vizsgálatához. Országos Közegészségügyi Intézet, Vízhigiénés Osztály (Methodological Guide to the hygienic bacteriological investigation of surface waters. Published by the National Institute of Public Hygiene, Department of Water Hygiene. — Budapest, 1977. (in Hungarian).

SCHIEFNER, K., DEÁK, Zs., KÁDÁR, M., CSANÁDY, M., BOZSAI, G. and SALACZ, T. (1978): A Balaton vízminőségének változása az elmult 20 év komplex vízhigiénés vizsgálatai alapján (Changes in the Water Quality of Lake Balaton on the Basis of Complex Water-Hygienic Studies of the last 20 years). — Egészségtudomány *22*, 117. (in Hungarian).

ULLRICH, E., CSANÁDY, M., DEÁK, Zs., PÉNZES, M. and BENCZE, E. (1977): Adatok a Pest megyei Duna szakasz szabad strandjainak vízminőségére (Data to the water quality of the riverside beaches along the Danube reach of Pest county). — Hidrol. Közl. *57*, 97. (in Hungarian).

VETRÓ, J., KISS, M. and MINDSZENTY, L. (1966): Higiéniai vizsgálatok a Tisza szegedi szakaszán (Hygienic investigations in the Szeged reach of river Tisza). — Hidr. Közl. *46*, 36. (in Hungarian).

Csongrád megye felszíni vizein létesített strandok bakteriológiai és kommunálhigiénés helyzete

Hegedüs Mária, Lévai Ibolya, Fodré Zsófia és Zsigó Margit

Csongrád megyei Közegészségügyi-Járványügyi Állomás, Szeged, Hungary

Kivonat

A szerzők 1979—1980-ban kiemelten foglalkoztak azzal a problémával, hogy a nyári hasznosítási idényben, Csongrád megye felszíni vizein létesített strandok az üdülés, fürdőzés vízisport céljára alkalmasak-e. A komplex felmérés alapján megállapították, hogy az üdülőterületek alapvető higiénés helyzete kielégítő és ugyanakkor megjelölték a legfontosabb feladatokat is. A hasznosítási idényben végzett vízbakteriológiai vizsgálatok eredményeit táblázatban tüntették fel a mintavételi helyek megjelölésével. A vízmintákban vizsgálták a Salmonella baktériumok előfordulását, valamint a coliform és a faecalis coliform baktériumok mennyiségét és egymáshoz viszonyított arányukat. Az eredményeket összehasonlították a vizsgált időszak vízhozam mennyiségével. A két év hasznosítási idényben végzett higiénés bakteriológiai vizsgálatok eredménye alapján felhívják a figyelmet arra, hogy Csongrád megyében csak Mártélyi holt Tisza-ág vize felel meg üdülés és vízisport céljára.

Bakteriolosko i komunalno-higijensko stanje podignutih strandova na otvorenim vodama županije Csongrád

Hegedüs Mária, Lévai Ibolya, Fodré Zsófia i Zsigó Margit

Zdravstveno-epidemiološka stanica županije Csongrád, Szeged, Hungaria

Abstrakt

Autori su se u toku 1979—1980 godine posebno zanimali problemom podobnosti štrandova, podignutih na otvorenim vodama županije Csongrád, za rekreaciju, kupanje i vodene sportove u toku letnje sezone korišćenja. Na osnovu kompleksnih istraživanja utvrdjeno je da rekreaciona područja zadovoljavaju osnovnim higijénskim zahtevima, i istovremeno su odredjeni i najvazniji Izadaci.

Rezultati bakterioloških analiza u sezoni korišćen ja rekreacionih centara, sa naznakom lokateta uzimanja proba, prikazani su tabelarno. Utrrdjivano je prisustvo Salmonella bakterija, količina Coliform i faecal Coliform bakterija i njihove medjusobne vrednosti. Rezultati su uporedjivani sa količinom protoka vode u sezoni ispitivanja.

Na osnovu rezultata dvogodišnjeg bakteriološkog ispitivanja ukazuje se na činjenicu da na području županije Csongrád samo mrtva Tisa Mártély odgovara za rekreaciju i upražnjavanje vodenih sportova.

БАКТЕРИОЛОГИЧЕСКОЕ И КОММУНАЛГИГИЕНИЧЕСКОЕ СОСТОЯНИЕ ПОВЕРХНОСТНЫХ ВОД ПЛЯЖЕЙ В ОБЛАСТИ ЧОНГРАД

М. Хегедюш, И. Леваи, Ж. Фодре и М. Жиго

Санитарно-энигемиологическая обл. Чонграг, Сегед, Венгрия

Резюме

Авторы в 1979—1980 годах занимались вопросами, что в летнем сезоне поверхностные воды Чонградской области, являются-ли подходящими с целью отдыха, купания и водного спорта.

На основании комплексного изучения было установлено, что в сущности гигиеническое состояние курортных мест является удовлетворительным к назначенным целям. В то же время к этому наметили самые близки задачи. Результаты проведенных водно-бактериологических исследований в приведенном сезоне в таблицах были представлены с указанием в них

изученных образцов. В водных образцах уточнили наличие бактерий салмионелла, а также количественные отношения бактерий колиформ и фекалис колиформ — в соотношениях друг к другу.

В сезонном периоде полученные результаты изложили в сравнительных отношениях водныммобьемом. На основании выполненных гигиеническо-бактеорологических исследований казалось, что в области Чонград для отдыха и водного спорта — только Мартейская старица реки Тисы является вполне подходящим.

Tiscia (Szeged) Vol. XVIII, pp. 23—31 (1983)

MICROCYSTIS TYPE PLANOCOCCUS STATE OF ANABAENA IN THE TRANSITORILY ALKALINIZED TISZA RIVER

I. Kiss

Department of Botany, Attila József University, Szeged
(Received June 25, 1981)

Abstract

During mass productions of *Anabaena spiroides* — owing mainly to anaerobic conditions and the accumulation of metabolic products — the trichomes broke up into so-called planococcus cells. The clumps of these cells were very similar to the colonies of *Microcystis*. The trichomes could also be induced to break up under experimental conditions. Such examinations were performed by author earlier, too, in the case of *Spirulina platensis*. He also observed such phenomena in connection with *Aphanizomenon* and *Oscillatoria*. These phenomena may have important bearings in the field of taxonomy, ecology and physiology.

Introduction

In standing waters I have observed on several occasions the breaking up of the trichomes of the species of *Anabaena* or their hormogoniums into independent cells. These cells remained together in the mucilaginous envelope of the trichomes, propagated there, and the clumps of them were very remindful of the thallus formations of varying shape of the genus *Microcystis*. If the origin of these cell clumps were unknown, we might easily take them for *Microcystis* thalli and this would cause trouble in their determination. I have raised this question also earlier, in the course of the investigations performed for a longer period on the trichomes of *Spirulina platensis* (Nordst.) Geitler during the mass growth of this species (Kiss 1957). It was also observed in connection with species of *Aphanizomenon* and *Oscillatoria*. Under unfavourable conditions this phenomenon is not infrequent.

This question deserves our attention also because the real existence of certain species belonging to genus *Microcystis* have been called in question by several authors. Huber—Pestalozzi characterized this genus as follows: "Eine systematisch sehr schwierige Gattung, da die Abtrennung gegenüber den Nachbargruppen *Aphanocapsa* und *Aphanothece* unscharf ist", and further: "Aber innerhalb der Gattung ist wiederum die Abgrenzung der Arten voneinander ebenso schwierig wie die Umgränzung der Gattung überhaupt". — "Die Schwierigkeit liegt darin, dass Merkmale, welche für eine Art charakteristisch sein sollten, auch als Stadien anderer Arten auftreten: auf diese Weise gibt es zahlreiche Übergänge und Zwischenformen" (Geitler) — ("It is a very difficult genus systematically, for its uncertain separation from related groups *Aphanocapsa* and *Aphanothece*". — "But inside the genus the separation of species from one another is also as difficult as the delimitation of the genus itself" — "The source of the difficulty is to be found in that features to be regarded as characteristic of one species appear also as stadiums of other ones and in this way numerous transitions in form occur" —). According to GEITLER and HUBER—PESTALOZZI *Microcystis aeruginosa* is probably identical with *M. flos-aquae*. HUBER—PESTALOZZI does even disbelieve the existence of *Microcystis scripta, M. ochracea* and *M. pseudofilamentosa* (GEITLER 1925, HUBER—PESTALOZZI 1938). In the form group of *Microcystis aeruginosa* STARMACH separated the f. *aeruginosa* (f. typica) ELENKIN and f. *flos-aquae* (WITTR.) ELENKIN (STARMACH 1966). FELFÖLDY (1972) claims that *Microcystis aeruginosa* and *M. flos-aquae* are independent species.

Our objective cannot be to negate the existence of the genus *Microcystis*, nevertheless it should also be emphasized that in this regard examinations on the formation and further fate of planococcus cells seem to be of key importance. In the judgement of the morphological characteristics of the single species ecological physiological methods should also be considered and the use of genetical methods is also urgent. Further experiments must be performed to elucidate as to which environmental conditions are necessary for the planococcus cells developing from trichomes to produce new trichomes. Namely, this has not been observed yet either under natural conditions or in laboratory cultures. In spite of that it is likely that every planococcus cell is able to produce a new trichome. In the following the planococcus formation of Anabaena spiroides Kleb. observed in the backwater of the Tisza river at town Csongrád will be reported.

Materials and Methods

The breaking up of the trichomes of *Anabaena spiroides* into planococcus cells took place in most cases in periods of lasting mass production. Such a mass production had been observed before in sodaic lakes (e.g. Fehér lake at Szeged) and in four backwaters of the Tisza river (Csongrád, Cibakháza, Rakamaz, Tiszaluc). Here the examinations performed in Csongrád backwater will be presented, since the algal flora of this water body was studied also in the period 1976—79, and this phenomenon could be observed there on several occasions. The transitory transformation of the water into alkaline (sodaic) one is likely to have also played a role in the breaking up of trichomes into planococcus cells, since in this time this phenomenon was generally observable in waters of 8—8.5 pH. The cause of alkalinization is due to the circumstance that the zone of sodaic soils between the Danube and the Tisza extends as far as here. Mass production of *Anabaena spiroides* lasted here for several months during summer 1978, and the surface of the blueish-green water layer of some cm thickness was covered by floating sausage-shaped algal clots. These were 1—2 cm in length and 0.5—1 cm in thickness, and in their inside parts the trichomes were tightly pressed together. Due to the unfavourable conditions of life, large-scale breaking up of trichomes into planococcus cells was observable.

Samples of mass production taken from various places were examined in living and fixed condition. For the fixation of samples 2—3% formaldehyde in water proded to be the best preservative. Experiments of culturing were performed in the laboratory both with clumped and nonclumped parts of the living material. The nonclumped sample of mass production was filtered to remove the planococcus cells from among the trichomes. This could ve accomplished only in part. The further fate of the sausage-shaped living bioseston clumps was studied so that one part of them was left unchanged in clumps of different sizes, the other portion was separated to constituent parts as much as possible and in the course of that care was taken to produce as little pressure as possible on the clumps. Live preparations were made from this material and the breaking up of trichomes into planococcus cells was examined at intervals. The forms of the living preparations were the following: 1. Aerobic preparations in Petri dishes, 2. Hermetically sealed material in glass tubes, 3. Preparations on excavated slide with air bubble (a greater or smaller air bubble was left over the material placed into the excavated slide before the sealing of its cover with wax), 4. Anaerobic preparation on nonexcavated slide without air bubble and sealed with wax.

Results

The enormous mass production extending over the whole area of the backwater during summer and autumn 1978 was inspected on four occasions: July 23, August 4, September 3 and October 24. Superficial and underwater bioseston samples were collected from various places in the littoral and open water. The samples showed that Anabaena spiroides was most variable morphologically and in regard of size. The number of the convolutions of the trichomes coiled in a spiral fashion varied between 2 and 10. The width of the convolution of the type form of the species was 40—50 μm, the lead of the convolutions of it the same of less. The cells were sometimes spherical, ranging from 7 to 9 μm in diameter, their width being generally greater than the length of cells. The cells always contained gas vacuoles, in summer in greater numbers, causing the trichomes of the bioseston to float entangled in the upper few cm thick layer of water during August and September. The heterocysts were spherical measuring 7 μm in diameter, the spores were elongated and slightly bent, 11—13 μm in width. Such a type form from an open water bioseston is seen in micrograph 1 of Table I. Trichomes with convolutions of 23—27 μm width and with lead of 18—20 μm also occurred in a minor amount. They may be ranged among var. contracta Klebahn (micrograph 2, Table I). More seldom trichomes with longitudinally compressed cells were also seen. The width of these cells were 7—8 μm, the length of them only 3—4 μm. They may have belonged into the form group of var. Talyschensis Wor.

Concerning structural condition of the mass production, the following observations could be made:

1. In the littoral, the overwhelming majority of trichomes produced sausage-shaped clumps, while in the open water the bioseston was rather made up of non-clumped, individual trichomes, exhibiting in some places syrup-like density. In this latter case, the stronger movement of water surface may have also had a role. In the open water, *Aphanizomenon flos-aquae* (L.) RALFS was also observed, but characteristic colonies of *Microcystis* were nowhere to be found.

2. In the bioseston clot, the trichomes of *Anabaena spiroides* exhibited various forms of breaking up into planococcus cells, especially from August. Inside the mucilaginous envelope of the trichomes the planococcus cells remained in groups, occasionally divided producing planococcus clumps of spiral shape. They simulated *Microcystis* colonies, and had we not known their origin, we might have mixed them up with real *Microcystis* colonies. This situation is illustrated in micrographs 4, 6, 7. The trichome seen in micrograph 6 belonged into the form group of var. *contracta* Klebahn. The breaking up into planococcus cells had just begun. The arrow points to a solitary heterocyst. Micrograph 7 shows a more advanced stage of planococcus formation of a trichome similar to the previous one. Here the cells had several cell divisions and formed spirally coiled clusters in the mucilaginous envelope. The clumps of trichomes were gradually entangled during summer to form a floating layer of 1—2 cm thickness at the water surface. Among the entangled trichome clots, however, solitary spiral trichomes still occurred and in the increasingly worsening environment they gradually broke up into individual cells. Micrograph 4 illustrates the formation of the planococcus colony. It is visible that in the mucilaginous envelope of sharp contour the cells are already arranged in rows of 4—5, and the cell clump is not only in the state of loosing its spiral character, but its division into 4—5 smaller cell clumps has also started.

3. Spherical bodies 1—2 μm in diameter, produced by the disintegration of cells into granules always occurred in the clumps consisting of planococcus cells, particularly in the spaces encircled by the entangled masses of clumped trichomes. The arrow in the upper left side of the colony of micrograph 4 points to such a disintegration. It is visible that the small granules are located in a group inside the mucilaginous envelope, showing that they are the products of the disintegration of a single cell. These cells are some 1 μm in diameter. Lower another arrow points to two small bodies which are in the process of releasing from the mucilaginous sheath. Their diameters are somewhat greater than those of the former ones: 1.5—2 μm. It was generally observed that this disintegration into granules in the trichomes or in the planococcus cells intensified with the increase of gas vacuoles in cells. The disintegration of this uniform cell structure seemed to be enhanced by strong vacuolization. The tigher the clustering of hormogoniums and planococcus cells, the more intensive will be the gaseous vacuolization and granule formation.

Experimental examinations

The objective of these examinations was to obtain more information about the ecological conditions of planococcus formation. The results of these experiments will be presented according to the four groups mentioned in Materials and Methods.

1. *Anabaena* trichomes collected from open water plankton and kept in Petri dishes under aerobic conditions seemed to remain undamaged for a longer period. E.g. micrograph 3 in Table I was taken of a material kept in a Petri dish for 3 months. The only change in that case was that the width of the convolutions of the sedimenting spiral trichomes decreased, the trichomes were nearly pressed in length into the same plain. Under such aerobic conditions the entangled masses of trichomes were less damaged, their hormogonium production and their breaking up into planococcus cells were also less intensive, and their disintegration into granules was also insignificant.

2. In glass tubes sealed air-tight, the braking up of trichomes into hormogoniums and planococcus cells was surprisingly frequent. Even the solitary trichomes

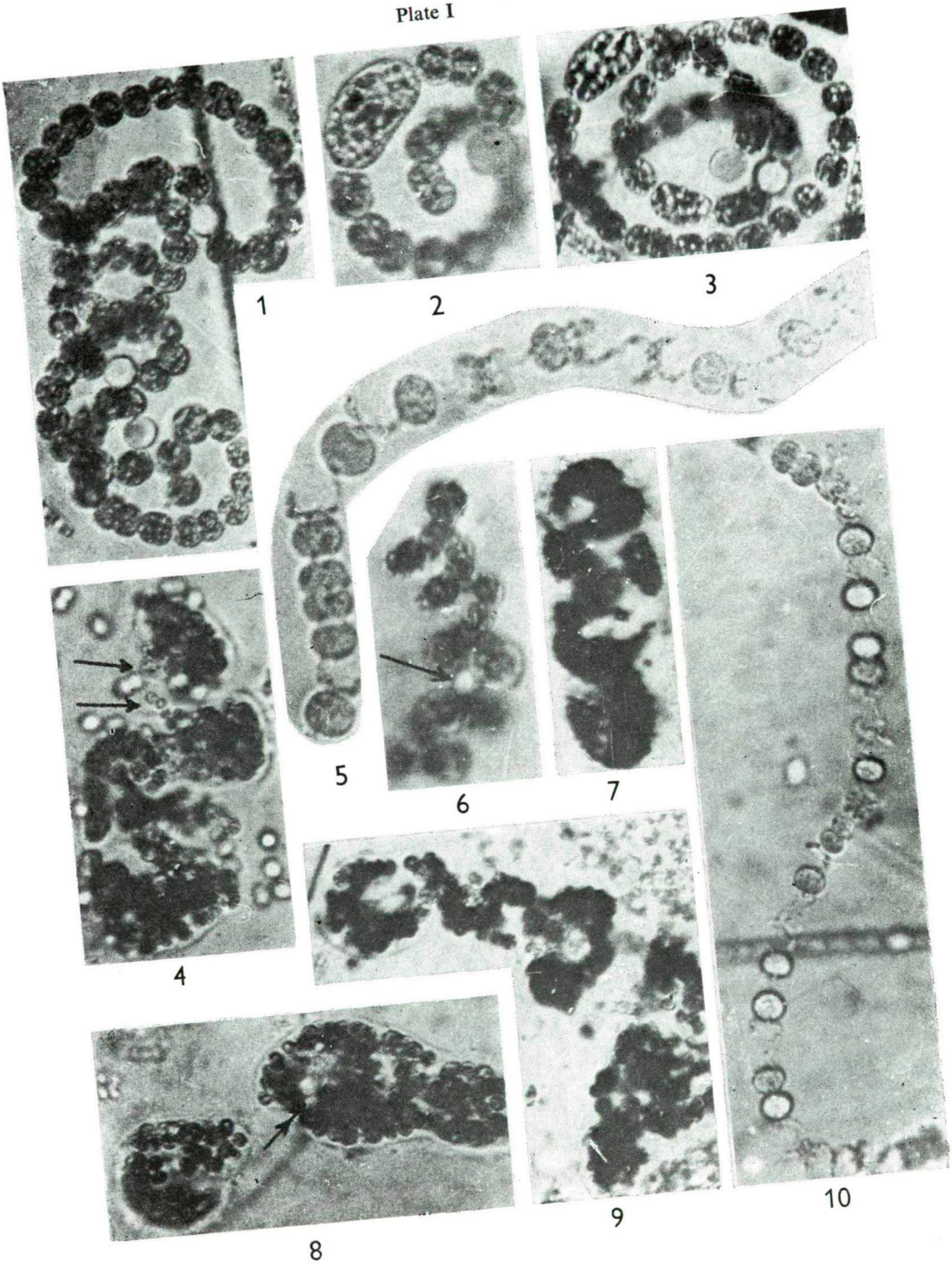
Plate I

1. Type form of *Anabaena spiroides* KLEBAHN from the bioseston of open water algal bloom, 700:1
2. *A. spiroides* var. *contracta* KLEBAHN from open water mass production, 900:1
3. Undamaged trichome of *A. spiroides* from 3-month-old aerobic culture, 700:1
4. Formation of a spiral planococcus mass by several divisions of *A. spiroides* cells in clotted bioseston, 400:1

5., 10. Some cells of *A. spiroides* broke up into small granules without the clustering of planococcus cells in sealed anaerobic culture on nonexcavated slide within three weeks. 5. = 1000:1, 10. = 500:1

6. Trichome of *A. spiroides* var. *contracta* from clotted bioseston at the beginning of its breaking up into planococcus cells, 600:1
7. An older planococcus cluster from the trichome of *A. spiroides* var. *contracta*. The cells in the cluster had divided more than once, 200:1
8. Trichomes of *A. spiroides* broke up into planococcus clusters in two months in a culture with air bubble on excavated slide and sealed, 300:1
9. The trichome mass of *A. spiroides* closed into a glass tube broke up into planococcus clusters within a few weeks-in-anaerobic environment. Disintegration of planococcus cells into granules in also visible, 300:1

Plate I



clustered closely together within a short time, and the single trichome spirals often piled transversally one upon the other were entangled in a net-like fashion. In such cases planococcus formation took place very soon. Such a case is shown in micrograph 9, Table I. It is seen that the breaking up of the single cells into granules has begun. If trichome masses formerly clumped together got under similar conditions, this phenomenon took place faster.

3. A similar process could be observed in preparations on excavated slides with air bubbles under the sealed cover slide. Trichomes nearer to the bubble broke up more slowly into planococcus cells and those remote from it faster. Micrograph 8 of Table I was taken of a clump more remote from the bubble, in the second month following setting in. Here the separation into smaller cell clumps is already visible. In the greater clump on the right, the clustering of trichomes took place also transversally, causing a very unequal grouping of planococcus cells. The arrow points to two light spots. These were heterocysts, which fell a little below the optical plane of the micrograph. One of them must have belonged to a transversal trichome. If clumped trichomes were placed into excavated slide, not only planococcus formation but also disintegration of cells into granules occurred.

4. In preparations on nonexcavated slides sealed without air bubble the trichomes of *Anabaena* were in the most unfavourable conditions. Here was planococcus formation and the disintegration into granules the most intensive and observed firstly. The spirals of solitary trichomes flattened, i.e. became laterally compressed and longitudinally elongated, the lead of the spirals increased, and their damages assumed extreme dimensions. Micrographs 5, 10 of Table I taken in the same time of solitary trichomes of the open water bioseston originated from preparations set in in the same time. Micrograph was taken of filtered material, micrograph 10 of an unfiltered, planococcus-containing material. The picture is the same in both cases: The disintegration of trichomes into small granules had begun before their breaking up, though 3 weeks before the setting in of preparations the trichomes were generally undamaged. Most trichomes exhibited the same picture. It is visible that the single cells resp. sections of trichomes were not the same in regard of their physiological conditions. It is likely that a so-called inequal division was also involved in that. The genetical inheritance of cells was obviously the same, but the hormonal dividedness between the young cells, the small local differences in the environmental factors produced differences also in the vitality of the single cells resp. cell groups.

Later the spiral planococcus clumps of *Anabaena spiroides* broke up into smaller colonies, or remained entagled in greater net-like, so-called "open-work" groups and having vegetated for a longer time became deceptively reminiscent of the genus *Microcystis*.

Discussion

The interpretation of the surprising morphological phenomena described in the foregoing may raise several questions. Of them two are waiting for an answer: 1. Are the clumps produced by the breaking up of trichomes viable?, 2. What induced the trichomes to break up into planococcus cells?

The first question is adressed to the future, since today we can only state both from the aspect of morphology and taxonomy that the cell clumps with mucilaginous envelope are similar to Microcystis colonies, and in a favourable medium remain undamaged for several months. The main point in this question is whether viability and vitality mean also perfectibility. This latter begets, however, another question: Are these planococcus cells able in isolated condition to produce new trichomes? Even if we could realize this today under suitable conditions still unknown, we could not negate with complete certainty the existence and biological reality of the genus *Microcystis*. For the negation of this genus it would be necessary to grow trichomes from the isolated cells of an admittedly "real" *Microcystis* species tp be regarded as constant. As long as we fail in doing this only circumspect examination is recommended, e.g. we should avoid identifying clumps of planococcus cells as *Microcystis* colonies. In the mass productions of undamaged *Spirulina* or other Cyanophyta possessing trichomes, *Microcystis* colonies can occur, and it is also likely that with the worsening of conditions the trichomes will braek up into planococcus cells. In many cases, their clusters are indistinguishable from *Microcystis* colonies. Serological methods may perhaps be useful in the real interpretation of these formations. Of course, the possible existence of serotypes can even here cause difficulties.

It is easier to answer the second question. It was observed both in natural mass productions of *Anabaena spiroides* and in labortory cultures that the clustering into clumps of trichomes, the crowdedness resulted in the formation of planococcus cells. I have observed this previously, too, when studying the enormous mass production of *Spirulina platensis* (NORDST.) GEITLER. In that case I could establish the following: "The breaking up into spherical cells of trichomes is certainly a useful process since due to the increased plasma surface, the release of metabolic products resp. aeration can take place easier". Further "... In this case planococcus formation is not a direct process of propagation, but a transformation provoked by unfavourable conditions into a state in which the organism is still able to eyist" (KISS 1957).

This breaking up of cells was observed also earlier in the case of Spirulina platensis. The trichomes of this organism started breaking up at the beginning of the second month in the sealed slide preparations, and during the third month following setting in all trichomes broke up into planococcus cells. In the 6th month the picture changed completely, the marginal cells of the planococcus clusters were still normal, they had retained their colour, but the cells located lower than the 5th—6th cell layer became colourless, lost their cellular structure and underwent complete autolysis (KISS 1957). It seems that for the retaining of the cellular structure a certain energy level is also necessary for the cells. This was observed also with other algal organisms.

The breaking up into planococcus cells was observed also with genera *Aphanizomenon* and *Oscillatoria*, in the case of the former under even more extreme conditions. In micrograph 10 of Table I, the trichome of *Aphanizomenon* is also dimly visible under the optical plane in an environment that caused the breaking up of the Anabaena trichomes into granules. The resistance of *Anabaena* seemed to be greater.

It can be stated on the basis of results that the single algal species may undergo great changes both morphologically and structurally and therefore their identification should be based on the full knowledge of their ontogeny.

References

FELFÖLDY, L. (1972): A guide for the identification of blue greens (Cyanophyta) in Hungary (in Hungarian only). — Vízügyi Hidrobiológia *1*, Vízdok, Budapest.

GEITLER, L. (1925): Cyanophyceae. In: PASCHER, A. (edit.): Süsswasser-Flora Deutschlands, Österreichs und der Schweiz. — Gustav Fischer, Jena, Heft *12*, 1—450.

GEITLER, L. (1930): Cyanophyceae (Blaualgen). In: RABENHORST L. (edit.): Kryptogamen Flora von Deutschland, Österreich und der Schweiz. — Akad. Verl. Leipzig. 2. Auflage, Bd. *14*, 1—1196.
HORTOBÁGYI, T. (1955): Die Rolle der Gasvakuole im System der Cyanophyceae (in Hungarian). — Bot. Közlem. *46*, 25—29.
HUBER-PESTALOZZI, G. (1938): Das Phytoplankton des Süsswassers. I. Teil: Allgemeiner Teil, Blaualgen, Bakterien, Pilze. In: THIENEMANN, A. (edit): Die Binnengewässer.—Schweizerbart'sche Verl., Stuttgart 1—342.
KISS, I. (1957): Über die Planococcus-Haufen der *Spirulina platensis* und die Frage des *Microcystis*-ähnlichen Zustandes (in Hungarian). — Szegedi Ped. Főisk. Évk. *2*, 35—65.
STARMACH, K. (1966): Cyanophyta — Sinice, Glaucophyta — Glaukofity. In: STARMACH, K. (red.): Flora slodkowodna Polski. Tom. *2*, 1—807. — Inst. Bot. Polska Akad. Nauk, Warszawa.

Az Anabaena Microcystis-jellegű planococcus állapota a Tisza folyó időnkénti alkalizálódó holtágában

I. KISS

Tiszakutató Munkacsoport Szeged

Kivonat

Az *Anabaena spiroides* tömegprodukciójában főként a levegőtlenség és az anyagcseretermékek halmozódására a trichomák ún. planococcus sejtekre estek szét. Ezek halmazai nagyon hasonlítottak a Microcystis kolóniákra. A trichomák szétesését kísérletekben is elő lehet idézni. Ilyen vizsgálatokat szerző korábban a *Spirulina platensis* esetében is végzett, de ilyen jelenségeket ritkán az *Aphanizomenon* és az *Oscillatoria* körében is észlelt. E jelenségek a taxonómia és a fiziológia terén jelentősek lehetnek.

Anabaena Microcystis-u slično planococcus-no stanje u povremeno alkalnim mrtvajama reke Tise

KISS I.

Radna grupa za istraživanje reke Tise, Szeged, Hungaria

Abstrakt

Pri masovnoj produkciji *Anabaena spiroides*, uglavnom usled anaerobnosti i nagomolavanja produkata metabolizma, trihome se raspadaju na tz. planococcus ćelije. Njihove su grupacije veoma slične Microcystis kolonijama. Raspadanje trihoma moguće je izvesti i eksperimentalnim putem. Autor je ranije vršio ovakve opite u slučaju *Spirulina platensis*, a slične pojave je redje primetio i na *Aphanizomenon*-u i *Oscillatoria*-ma. Ove pojave mogu biti od značaja za taxonomiju i oblasti fiziologije.

ХАРАКТЕРНОЕ СОСТОЯНИЕ В ПЕРИОДИЧЕСКИ ЩЕЛОЧИЗИРОВАННОЙ СТАРИЦЕ РЕКИ ТИСЫ

И. Кишш
Рабочая группа изучения Тисы, Сегед, ВНР

Резюме

Anabaena spiroides в своей массовой продукции, при недостатке воздуха и накопления продуктов обмена веществ распадается на трихомы — клетки planococcus.

Эти накопления очень похожие на колонии *Microcystis*.

Распад трихомов можно вызвать искусственно — с помощью опытов. Такие опыты автор проводил и раньше с *Spirulina pratensis*. Иногда Можно наблюдать такие явления также в среде *Aphanizomenon* и *Osscillatoria*. Все эти явления могут иметь важное значение в области таксономии и физиологии.

Tiscia (Szeged) Vol. XVIII, pp. 33—46 (1983)

THE ROLE OF SEASONAL, EDAPHIC AND BIOTIC FACTORS IN THE DEVELOPMENT OF PHYTOPLANKTON COMMUNITIES IN THE CIBAKHÁZA BACKWATER OF THE TISZA

I. KISS

Department of Botany, Attila József University, Szeged
(Received June 25, 1981)

Abstract

During the three-year seasonal studies carried out in the great backwater of the Tisza at Cibakháza 215 algal taxa were identified. It was found that the formation of algal communities was influenced by seasonal, edaphic and biotic factors. Concerning seasonal distribution of algae, the summer period proved to possess a prime role both qualitatively and quantitatively, with the dominance of climatic and meterological factors. The community-forming effect of edaphic factors is based on the availability of utilizable and incorporable materials, whilet hat of the biotic ones on "toleration" or "liking" as well as the opposites between synergism and antagonism. Pollution with *fertilizing* organic substances was the principal factor in inducing algal blooms. This also verifies that saprobity and trophity are related with each other not only by the mineralization of organic materials, but also by the selective uptake and utilization of certain organic compounds by certain algae. These considerations basically influence the question of algal indication and are at the same time significant from the aspect of environmental protection, too.

Introduction

Of the backwaters of the Tisza, the so-called "halovány" one at Cibakháza is the greatest, its length being fairly in excess of 20 km. It meanders in irregular U shape on the left bank of the Tisza, and the village Cibakháza is located along its eastern section. Here the sloping shore of the backwater was transformed into a fashionable strand. On the bank opposite to the village an agricultural factory unit was planted. Along the eastern shore line several anglers' camps were established, and in one of them a tablet with the inscription "Feeding Place" was also to be found (this meant the feeding place of fish. This was, however, not real feeding and caused only pollution). These facts are suggestive of the increasing eutrophization of the backwater, and because of this it was considered important to extend studies over the algal flora, algal vegetation, the forms of algal communities in this water body. The algological analyses were performed only in the esatern part of the backwater in the area of the village and its environment. The hazard of pollution with organic materials was here the greatest. The course of the western part of the backwater is only slightly bent and the agricultural environment of the settlement Nagyrév polluted the water here in a lesser degree. The soil of the eastern shore line exhibited signs of sodification, particularly in the flat parts east of the village. There on one occasion the pH of the water was 8.2. In summer and autumn during periods of collecting, the water was slightly alkaline, with 7.6—7.8 pH values. In the southern section 8.0 pH was measured only on two occasions.

The algal flora and its vegetation forms were analyzed for 3 years. The samples were taken seasonally on the following days: May 30, July 4, October 3, 1976, May 22, August 11, October 26, 1977, May 21, August 4, September 8, 1978. In the table the seasons were marked with letters: a=spring, b=summer, c=autumn. In the allocation of the sampling places the different environmental conditions were also taken into consideration. The constant sampling places were the following ones: 1. The open water at the strand of the village. 2. The open water at the great winding south of the village. 3. The water at the landing stage between the great winding and the village. 4. The open water at the bank opposite to the village. 5. The relatively shallow part of the channel north of the village. Occasionally samples were taken from other places as well. At sampling place 2 the greatest depth of water was approx 4 m. In the section of the channel north of the village, depth of water varied between 0.5 m and 1 m only.

Materials and Methods

The algae were identified in living condition and for the examination of the quantitative relationships of phytoplankton fixed material was used. In these examinations the drop method applied also earlier was used. The course of this procedure was the following: From the sedimented seston of each liter fixed material a concentrate of 10 ml was made. After vehement shaking one drop was taken from this concentrate with a standard pipette for wet preparation the volume of which was 50 mm^3 on the average. The quantitative values of each water sample were determined on the basis of 10 wet preparations with 5 grades. The grades 1—5 figure in the seasonal columns (a, b, c) of Table I and their meaning is the following: 1 = organism of rare occurrence in the water sample (only 1—5 specimens occurring in the 10 preparations), 2 = sporadic occurrence (in 10 preparations only 6—10 individuals were visible), 3 = frequent occurrence (there were a few individuals in each preparation), 4 = very frequent occurrence (in one preparation numerous, at least 15—20 individuals were found), 5 = water bloom with mass production (the water was stained, mostly stained green due to the great number of organisms). This method is still of estimatory value, nevertheless it makes a rather good approximation possible. The first twogrades can be expressed with approximating limits in terms of liter. Because the volume of the drop resp. wet preparation is known, concrete counting beyond the former grades can also be performed by reckoning over into liter. This is, however, very lengthy. In the case of filamentous algae the case is more difficult, since we are compelled to have recourse to appraisal. Estimation is made on the basis of the number of the places of occurrence, the area of extension of the particular population, the extension of the filaments towards depth, and the density of the filaments.

Results and discussion

During the investigations in the backwater at Cibakháza 215 species resp their taxa (variations, forms) were identified. Their distribution according to phyla was the following: Cyanophyta 50, Euglenophyta 27, Chrysophyta 49, Pyrrophyta 8, Chlorophyta 81. The dominance of phylum Chlorophyta in regard of taxons was evident also here as in the majority of backwaters. It was followed by Cyanophyta and Chrysophyta with almost identical taxon numbers. In the latter phylum, Bacillariophyceae had a prime role. In most cases, this proved to be also characteristic of our surface waters.

In the first survey of numerical data, the contribution of Euglenophyta and Pyrrophyta to the phytoplakkton of the backwater seems negligible. We can, however, approach the actual situation if the organisms and their communities are analyzed from ecological aspect, i.e. according to the places of occurrence.

Separate presentation of the algal communities of the aforementioned 5 sampling places would have been perhaps better from ecological, physiological aspects. Unfortunately, the space given here does not allow this. The first objective of this study is namely to show the seasonal appearance of the single species and societies. The list presented in Table I is very suitable for this purpose, since it shows clearly the qualitative and quantitative changes of the algal communities according to the different vegetation periods. After this can follow the analysis from edaphic aspect, with the brief characterization of the various potentialities of the different sampling places and their community-forming effect. The seasonal changes in the different places of sampling are namely identical or nearly identical, while the edaphic circumstances of the various sampling places are usually different. Seasonal changes are equally uniformly affected by atmospheric events, since "... the atmosphere is the widest environment producing the most general effects. Its changes usually exert a primary influence on the shaping of the other environmental factors and conditions" (Kiss 1951, 1952).

On the basis of the aforementioned considerations the algal flora of the Cibakháza backwater can be described in the following:

1. The greater species number of algae during summer is generally suggestive of seasonality. This applies particularly to phylum Euglenophyta, the 27 taxa of which could be observed in each sampling place during each summer. Summer populatedness varied from 70% to 90% relative to total algal population. Chrysophyceae classis was a particular exception to this summer "predominance", since its members mostly appeared during spring. A similar phenomenon could be observed also in the Conjugatophyceae classis of green algae. In addition to climatic factors edaphic circumstances were probably also involved in this "liking for spring", since these organisms prefer less polluted waters. During spring the backwater contained less decomposing organic materials. The summer preponderance of seasonality manifested itself not only in qualitative relationships, but in quantitative occurrences, as well. The individual number of each taxon was generally the greatest in summer, and mass productions also occurred in summer. The summer maximum populatedness diminished by autumn, but the presence of algae in autumn was usually in excess of the occurrence of algae in spring both qualitatively and quantitatively. The backwater was characterized by species that occurred in each vegetation period. These were the following ones: *Aphanizomenon flos-aquae, Aphanizomenon flos-aquae* var. *Klebahnii, Aphanizomenon Issatschenkoi, Anabaena solitaria* f. *planctonica, Anabaena variabilis, Romeria gracilis, Oscillatoria tenuis, Phormidium luridum, Phormidium tinctorium, Lyngbya limnetica, Caloneis amphisbaena, Gomphonema acuminatum, Ceratium hirnudinella, Tetraedron minimum, Tetraedron proteiforme, Kirchneriella contorta* var. *lunaris, Ankistrodesmus angustus, Ankistrodesmus falcatus, Scenedesmus acuminatus, Scenedesmus bicaudatus, Scenedesmus denticulatus, Crucigenia tetrapedia, Crucigenia truncata, Cladophora fracta. Aulosira fertilissima* and *Characium Sieboldii* of uncertain identification proved to be very rare. During these 3-year studies the could be observed only on one occasion.

2. Water blooms could be observed during three excursions: 4 on July 4, 1976, one on October 3, 1976, and two on August 4, 1978. These algal communities were particular cases in regard of both the edaphic factors and the seasonal ones of the society. Their common feature was that some species of the community exhibited a relatively fast and mass growth and by means of their dominance limited or inhi-

bited the growth of other species. The phenomenon of "accumulation" in time is a characteristic feature of algal mass productions. This accumulation in time means that the numerical increase of algae or the invasion of the increased algal mass takes place in almost the same time. Suitable nutrients and stimulatory substances as the edaphic factors in the water are also likely to be involved in such increases. Of the seasonal factors the favourable atmospheric conditions, in the first approximation mostly the cyclonic-depressed, praefrontal weather may come into consideration. However, their atmospheric physical content is for the most part unknown. The surprising phenomenon of the accumulation of algal mass productions is well-known, and the herdsman in the puszta must have used it in the past for the prognosing of the weather. It also happens even today that we hear a brief, concise popular weather-forecast: "... the water is greening, rain is approaching". This old experience was the starting point of these studies some 50 years ago. It appears that besides the aforementioned seasonal and edaphic factors certain biotic ones are also involved in these mass productions. These factors increase vitality, whereby the algae can take advantage in a greater degree of the conditions of life. In 1925 Rapaics claimed that the phenomenon of water blooms is similar to the increase of bacteria during epidemics (RAPAICS 1925). Increase of vitality may play a role here, too, and in the case of pathogenic bacteria may be perhaps ranged into the category of virulence. I also used the term "virulence" for the designation of the factor group increasing algal vitality in a figurative sense and without its detailed explication (KISS 1951, 1952). The six blooms observed at Cibakháza were the following:

a) In the littoral of the landing stage a massive algal bloom of Aphanizomenon flos-aquae was observed on July 4, 1976 which caused the grayish-blueish-green discoloration of the water in a section of about 200 m length and 20—25 m width. In the trichomes of *Aphanizomenon* the cells were mostly considerably constricted at the cross-walls. This may have been an ecotype (1. in Plate I). Associated species of water blooms were also green algae: Aphanizomenon Issatschenkoi (6. in Plate I), *Anabaena affinis* (2. in Plate I), *Oscillatoria tenuis* (4. in Plate I), *Oscillatoria sancta* (5. in Plate I), *Trachelomonas granulosa, Trachelomonas volvocina.* On October 3, 1976 this water bloom still persisted, extending over areas of even greater extent, but showing signs of disorganization in certain places.

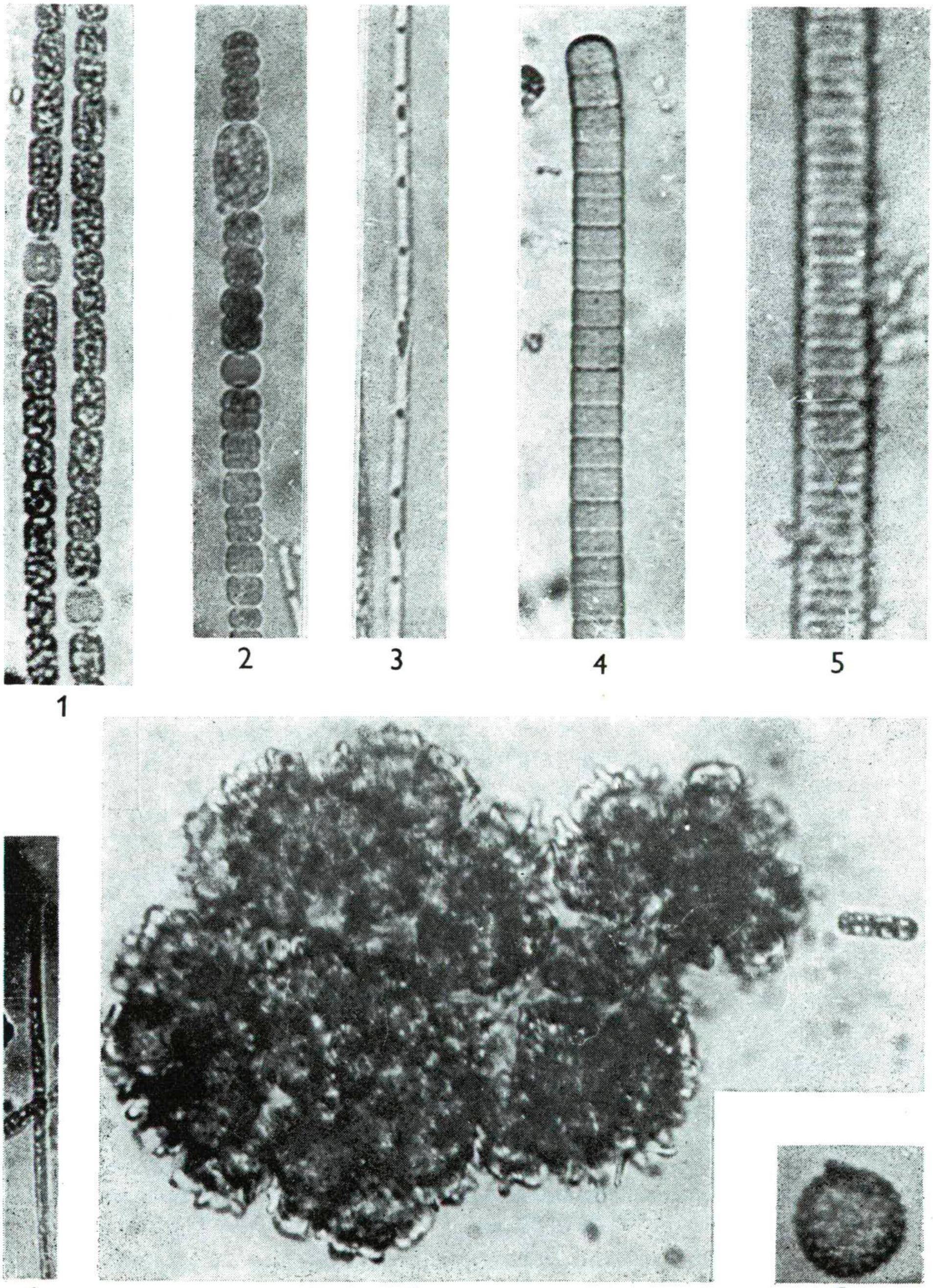
b) The grass green water bloom of *Eudorina elegans* which discolorated the water in an area of 20—25 m^2 on July 4, 1976, was enclosed by this enormous bloom of *Aphanizomenon*. Associated species were: *Oscillatoria planctonica* (3. in Plate I), *Lyngbya limnetica, Trachelomonas hispida, Cymatopleura solea, Pediastrum Boryanum,* and sporadically *Pteromonas angulosa.* It was visible at the boundary line of the two mass productions, that the bloom of *Eudorina* had been of greater extension before, and that at the time of sampling its replacement by the invading Aphanizomenon had started. There was no sign of the bloom of *Eudorina* on October 3.

c) On July 4, 1976, at the margin of the village strand in the nearly cut-off

Plate I

1. *Aphanizomenon flos aquse* (L.) RALFS 900:1
2. *Anabaena affinis* LEMM. 1000:1
3. *Oscillatoria planctonica* WOLOSZ. 1000:1
4. *Oscillatoria tenuis* AGARDH 1000:1
5. *Oscillatoria sancta* (KÜTZ.) GOM. 700:1
6. *Aphanizomenon Issatschenkoi* (USSACZEW) PROSCHKINA-LAWRENKO 400:1
7. *Phormidium mucicola* HUBER-PASTALOZZI et NAUMANN 600:1
8. *Coelosphaerium Keutzingianum* NÄGELI 500:1

Plate I



shallow water, the bloom of *Chlamydomonas multitaeniata* produced a spotted, light grass green discoloration of water. The bioseston sedimented on the substrate previously was just in the state of swarming. Associated species were: *Coelosphaerium Kuetzingianum* (8. in Plate I), *Cyclotella Meneghiniana, Asterionalla formosa, Pandorina charkowiensis, Pandorina morum, Selenastrum Bibraianum, Pediastrum Boryanum.*

d) In the same period, the littoral of the backwater opposite to the village as well as the open water there in a section of 70—80 m length and 15—20 m width possessed a grass-green colour. The water bloom was produced by *Euglena polymorpha.* Here the littoral must have been polluted earlier with organic fertilizing substances. Associated species were: *Trachelomonas Dybowskii, Trachelomonas hispida, Trachelomonas scabra.*

(e) During summer, 1978, *Euglena polymorpha* produced a mass production in the former place. On August 4, only the littoral became green in colour. Here, too, organic fertilizing substances must have got into the water. Associated species were the following: *Trachelomonas scabra, Trachelomonas volvocina, Cymatopleura solea, Tetraedron proteiforme, Scenedesmus acuminatus, Pediastrum biradiatum.*

(f) On August 4, 1978, the light green mass production of Kirchneriella contorta var. lunaris was observed in a shallow dip of the littoral opposite to the village. The cells smaller than normal were often broken up into particles of 1—2 μm diameter. Associated species were the following: *Cymbella affinis, Oocystis cingulatus, Scenedesmus ecornis.*

3. The appearance of *Phormidium mucicola* in the communities was novel. Its trichomes were imbedded into the entangled mass of 3-celled hormogoniums of *Aphanizomenon flos-aquae.* The great mass seen in photo 7 of Table I consists of at least 5—6 hormogonium masses and at the peripheries of the hormogonium masses the trichomes of *Phormidium* extending in the form of thin filaments are seen. At the right side margin of the picture one short hormogonium of *Aphanizomenon* is visible. This associations was particularly frequent in the bloom of *Aphanizomenon* in summer and autumn 1976. The water was covered in places by a thick syrup-like mass and the surface of that formed gradually a thin film as a consequence of evaporation. It could be observed in samples taken from that film that the clustered hormogoniums surrounded the small trichomes of *Phormidium.* This mechanism may be explained by the coagulation of the colloidal mucilaginous sheath. In the presence of iron (Fe^{+++}) cations coagulation can take place very quickly, particularly in dry weather.

4. From edaphic aspect, the two blooms of *Euglena polymorpha* in the backwater of Cibakháza were signs suggesting that pollution with fertilizing organic materials plays an important role in eutrophication. Since the thirteens it has been often observed that in waters polluted with fertilizing organic materials or decomposing organic substances, enormous blooms of species belonging to Euglenophyta can occur (Kiss 1939, 1951, 1952, 1970, 1976). In the sea at the point of inflow of the sewer of the Finnish metropolis and in the brackish water under the ice cover of the sea Välikangas (1922) observed the great mass production of *Euglena viridis.* It is essential from the point of view of biotic factors that the associated species of the water blooms in the backwater at Cibakháza exhibited a rather great tolerance and the algae occurring concurrently in great numbers in the same place call our attention to the possibilities of synergism. *Aphanizomenon flos-aquae,* the bloom of which inhibited and later stopped the mass production of *Eudorina elegans* was an example of open antagonism. The antagonism between these two species was observed also

Table I

No	Species (taxon)	1976			1977			1978		
		a	b	c	a	b	c	a	b	c
	Phylum: Cyanophyta									
1.	*Microcystis flos aquae* (WITTR.) KIRCHN.	1	3	2		2			3	2
2.	*Gomphosphaeria aponina* KÜTZ.		2	1		1	1		2	
3.	*Coelosphaerium Kuetzingianum* NÄGELI		3		1	2		1	2	1
4.	*C. Naegelianum* UNGER		2	1		1				
5.	*Merismopedia glauca* (EHR.) NÄGELI		1		1	2				
6.	*Dactylococcopsis raphidioides* HANSG.	1	2	2	1	2	2		1	
7.	*? Aulosira fertilissina* GHOSE						1			
8.	*Aphanizomenon flos-aquae* (L. RALFS	2	5	5	1	2	4	3	4	4
9.	*A. flos-aquae* var. *Klebahnii* ELENKIN	1	3	3	2	3	3	2	3	3
10.	*A. flos-aquae* f. *gracile* (LEMM.) ELENK.		2	2		2		1		
11.	*A. Issatschenkoi* (USSACZ.) PROSCHK. LAVR.	2	3	1	1	3	1	1	2	1
12.	*Anabaena aphanizomenoides* FORTI		2		1	2	1	1		
13.	*A. affinis* LEMMERMANN		3	2			2	1		
14.	*A. solitaria* f. *planctonica* (BRUNNTH.) KOMÁREK	1	2	2	1	1	3	1	1	1
15.	*A. spiroides* KLEBAHN		3			4	1		3	2
16.	*A. variabilis* KÜTZING	1	2	1	1	3	2	1	2	2
17.	*A. variabilis* f. *crassa* WORONICHIN		1	1	1	2				
18.	*Romeria gracilis* KOCZWARA	1	2	2	1	3	1	1	2	1
19.	*R. leopoliensis* (RACIBORSKI) KOCZWARA		1	1		2	1	1	2	
20.	*Spirulina laxissima* G. S. WEST		2	1		3	2		2	1
21.	*Oscillatoria acutissima* KUFFERAT		2		1	2	1		1	
22.	*O. angustissima* W. et G. S. WEST	1	2			2	1			
23.	*O. deflexa* W. et G. S. WEST		2	2			3			
24.	*O. Lauterbornii* SCHMIDLE			3			1	1	1	
25.	*O. Lemmermannii* WOLOSZYNSKA	2	1	1		1	1	1	1	
26.	*O. limnetica* LEMMERMANN	1	3		1	2		2		
27.	*O. minima* GICKLHORN		2				1	1	1	
28.	*O. pseudogeminata* G. SCHMID		1				2	2		
29.	*O. planctonica* WOLOSZYNSKA	1	2	2	1	3	1	1	2	2
30.	*O. subtilissima* KÜTZING		2	2		3	1	1	1	1
31.	*O. sancta* (KÜTZ.) GOMONT	1	4	2	1	2		2		
32.	*O. tenuis* AGARDH	1	2	3	1	3	1	1	2	1
33.	*O. trichoides* SZAFER		3	1		3	2		2	
34.	*Phormidium corium* (AGARDH) GOMONT	1	2	2	1	2	2		2	
35.	*Ph. foveolarum* (MONTAGNE) GOMONT		3	1		2				
36.	*Ph. incrustatum* (NÄGELI) GOMONT		2	2		1			2	
37.	*Ph. luridum* (KÜTZ.) GOMONT	1	2	2	1	1	1	1	2	1
38.	*Phormidium molle* (KÜTZ.) GOMONT		2		1	3	1	1	2	1
39.	*Ph. mucicola* HUBER—PESTALOZZI et NAUMANN		3	1		2	2		2	1
40.	*Ph. purpurascens* (KÜTZ.) GOMONT	1	3	1	1	1		1	2	1
41.	*Ph. tenue* (MENEGHINI) GOMONT		1			1	1		1	
42.	*Ph. tinctorium* KÜTZING	2	3	2	2	3	1	1	1	1
43.	*Lyngbya bipunctata* LEMMERMANN		2	1		1			1	
44.	*L. endophytica* ELENKIN et HOLLERBACH		3				1			
45.	*L. Hieronymusii* LEMMERMANN	1	2			1		1	1	
46.	*L. Lagerheimii* (MÖBIUS) GOMONT			2		1	1			
47.	*L. limnetica* LEMMERMANN	1	2	2	1	2	1	1	2	1
48.	*L. lutea* (AGARDH) GOMONT		1	1		1	1		1	1
49.	*? L. mucicola* LEMMERMANN		2			1				
50.	*L. putealis* MONTAGNE			1		1	1		2	1
	Phylum: Euglenophyta									
1.	*Euglena acus* EHRENBERG	1	2	1		1	1		1	1
2.	*E. Ehrenbergii* KLEBS		3			2			2	1
3.	*E. limnophila* LEMM.		2			2	1		1	

No	Species (taxon)	1976			1977			1978		
		a	b	c	a	b	c	a	b	c
4.	*E. oxyuris* var. *minor* DEFLANDRE	1	2	1		2	1		1	1
5.	*E. pisciformis* KLEBS		2	1		1			1	
6.	*E. polymorpha* DANGEARD		5	2		3	1		5	1
7.	*E. proxima* DANGEARD		3	1		1	1		2	1
8.	*E. thinophila* SKUJA		2			1			2	
9.	*Lepocinclis fusiformis* (CARTER) LEMM.		3	2		2			2	
10.	*L. ovum* (EHR.) LEMM.		2	1		1			2	1
11.	*L. teres* (SCHMITZ) FRANCÉ		1	1		2	1		1	
12.	*L. texta* (DUJARDIN) LEMMERMANN	1	2	1	1	1	1		1	
13.	*Phacus acuminatus* STOKES	1	1	1		2	1		1	1
14.	*Ph. caudatus* HÜBNER		2			2	1		2	
15.	*Trachelomonas crebea* KELLICOTT		2	1		2	1		2	
16.	*Tr. Dybowskii* DREZEPOLSKI		2	1		1	1		1	
17.	*Tr. granulosa* PLAYFAIR		1			2			1	1
18.	*Tr. hispida* (PERTY) STEIN		1			1			2	
19.	*Tr. hispida* var. *crenulatocollis* f. *recta* DEFL.		2	1		1	1		2	
20.	*Tr. intermedia* DANGEARD		2			3	2		2	1
21.	*Tr. Lefevrei* DEFLANDRE		2			2		1	1	
22.	*Tr. oblonga* var. *truncata* LEMM.		1			1	1		2	
23.	*Tr. scabra* PLAYFAIR		2	2	1	2	1	1	2	1
24.	*Tr. volvocina* EHRENBERG		2	1		1			1	
25.	*Tr. volvocina* var. *derephora* CONRAD	1	1	1		2			2	1
26.	*Strombomonas Deflandrei* (ROLL) DEFL.		3	2		2	1		1	1
27.	*Str. verrucosa* var. *zmiewika* DEFL.	1	2	1		3	1		1	
	Phylum: Chrysophyta Classis: Xanthophyceae									
1.	*Characiopsis minor* PASCHER		1				2			
2.	*Centritractus belonophorus* LEMMERMANN		1	1		1	1		1	
3.	*C. dubius* PRINTZ	1	1		2			1		
4.	*Ophiocytium capitatum* WOLLE	1			1					
5.	*Tribonema monochloron* PASCHER et GEITLER		2		1	1			1	
6.	*Tribonema* spec.	1	2							
7.	*Vaucheria* spec.		2	1		3	1		2	
	Classis: Chrysophyceae									
8.	*Chrysococcus ornatus* PASCHER	1	1		1			1		
9.	*Chrysoglena verrucosa* WISL.	1			1			1		
10.	*Bicoeca planctonica* KISSELEW	1	2			1		1		
11.	*Dinobryon divergens* IMHOF	1	2		2	2		1	2	
	Classis: Bacillariophyceae									
12.	*Melosira granulata* var. *muzzanensis* (MEISTER) BETHE	1	1			1		1		
13.	*M. varians* C. A. AG.		1			1				
14.	*Cyclotella compta* (EHR.) KÜTZ.	2	1		2			1	1	
15.	*C. Meneghiniana* KÜTZING		2	2	1	2	1	1	2	2
16.	*Diatoma vulgare* BORY		1	1		1		1		
17.	*Fragilaria capucina* DESMAZIERES			1		2				
18.	*Asterionella formosa* HASSALL		3	1		1	1		1	1
19.	*Synedra acus* (KÜTZ.) HUSTEDT		1	2		2			1	
20.	*Eunotia praerupta* var. *inflata* GRUNOV	1	2	1		1	1	1	1	1
21.	*Cocconeis placentula* var. *euglypta* (EHR.) CLEVE	1	1	1		1		1	1	
22.	*Caloneis amphisbaena* (BORY) CLEVE	1	1	1	1	1	1	1	1	1
23.	*Navicula cincta* (EHR.) KÜTZ.		2	1			2			1
24.	*N. cryptocephala* KÜTZING		1	1		1	1		1	
25.	*N. cryptocepahala* var. *venata* (KÜTZ.) GRUN.		2	2		1			1	
26.	*N. gregaria* DONKIN		2	1		2			1	

No	Species (taxon)	1976			1977			1978		
		a	b	c	a	b	c	a	b	c
27.	*N. lanceolata* (AGARDH) KÜTZING	1	1			1			1	
28.	*N. menisculus* var. *meniscus* ACHUMANN		2	1			1			
29.	*Amphora commutata* GRUNOW		1	1		2		1	1	1
30.	*A. normani* RABENHORST		2	1	1	1	1	1	2	
31.	*A. ovalis* KÜTZING	1	1			1	1		1	1
32.	*A. venata* KÜTZING		1		1	1	1		1	1
33.	*Cymbella affinis* KÜTZING		2	2		1	2		2	2
34.	*C. cymbiformis* (KÜTZ.) V. HEURCK		1			1	1		1	
35.	*C. cystula* (HEMPRICH) GRUNOW	1	1		1	1			1	1
36.	*C. cystula* var. *maculata* (KÜTZ.) V. HEURCK	1	1			1		1	1	
37.	*C. prostrata* (BERKELEY) CLEVE		2	1		1			1	
38.	*C. ventricosa* KÜTZING			1		1				
39.	*Gomphonema acuminatum* EHRENBERG	1	3	2	1	2	1	1	2	2
40.	*G. acuminatum* var. *trigonocephala* (EHR.) GRUN.		1				1		1	1
41.	*G. augur* EHRENBERG		2	1		2		1	2	1
42.	*G. constrictum* var. *capitata* (EHR.) CLEVE		2			1				
43.	*G. olivaceum* (LYNGBYE) KÜTZING		1			1				
44.	*G. parvulum* var. *subelliptica* CLEVE			1		2	1		1	
45.	*G. tergestinum* (GRUN.) FRICKE					1			1	
46.	*Epithemia zebra* var. *porcellus* (KG.) GRUN.		1					1	2	1
47.	*Nitzschia capitellata* HUSTEDT		2				1			
48.	*N. palea* (KÜTZ.) W. SMITH			1		1	1		1	
49.	*Cymatopleura solea* (BRÉB.) W. SMITH		1			1			1	1
	Phylum: Pyrrophyta									
1.	*Cryptomonas* spec.	1			1					
2.	*Gymnodinium rotundatum* KLEBS				1	1		1		
3.	*Glenodinium edax* SCHLLING				1					
4.	*G. pulvisculus* (EHR.) STEIN	1	1			1		1	1	
5.	*Peridinium aciculiferum* (LEMM.) LEMM.		2			1				
6.	*P. cinctum* (O. F. M.) EHR.	1	1	1		1		1		
7.	*P. palatinum* LAUTERB.		2	1		1	1	1	1	1
8.	*Ceratium hirundinella* (O. F. MÜLLER) SCHRANK	1	4	2	1	3	1	2	4	1
	Phylum: Chlorophyta Classis: Chlorophyceae Ordo: Volvocales									
1.	*Chlamydomonas multitaeniata* KORS.		5	1		2		2		
2.	*Pteromonas angulosa* LEMMERMANN	1	2		2	3		2	2	
3.	*Pandorina morum* (MÜLLER) BORY		2			2	1	1	2	
4.	*P. charkoviensis* KORS.		3	1		3	1	1	2	
5.	*Eudorina elegans* EHR.	1	5	2		2		1	2	
	Ordo: Chlorococcales									
6.	*Tetraedron caudatum* (CORDA) HANSGIRG		2	1		2	1		3	1
7.	*T. caudatum* var. *punctatum* LAGERHEIM		1			1	2		1	
8.	*T. incus* (TEIL) G. M. SM.			1		2	1		1	1
9.	*T. minimum* (A. BRAUN) HANSGIRG	1	2	2	1	3	1	1	3	1
10.	*T. minimum* var. *apiculatum* REINSCH		1	1		2	1		1	1
11.	*T. muticum* (A. BRAUN) HANSGIRG		3	3		2	3	1	3	1
12.	*T. proteiforme* (TURN.) BRUNNTH.	1	1	2	1	2	1	1	2	1
13.	*T. triangulare* KORS.		1		1	1	1		1	1
14.	*T. trigonum* (NÄG.) HANSGIRG	1	1		1	2	1	1	1	1
15.	*Characium Braunii* BRÜGG.		2			1	1		2	1
16.	*Ch. ensiforme* HERMANN				1	1	1		1	
17.	*Ch. Naegelii* A. BRAUN	1	1	1		1	1			1
18.	*Ch. Sieboldii* A. BRAUN			1						

No	Species (taxon)	1976			1977			1978		
		a	b	c	a	b	c	a	b	c
19.	*Oocystis cingulatus* Hortob. et Németh		2			1	1	1	1	
20.	*O. Marssonii* Lemmermann			1		1	1			1
21.	*O. natans* (Lemm.) Lemm.	1			1	1		1		
22.	*Chodatella maxima* Hortob.					1			2	2
23.	*Coenocystis planctonica* Korsikov	2	1	3		2			2	1
24.	*Lagerheimia Griffithsii* Fott						1		1	
25.	*Franceia Droescherii* (Lemm.) Kors.		1			1	1			
26.	*Chodatellopsis elliptica* Korsikov							1	1	
27.	*Nephrochlamys allanthoidea* Korsikov	1				1	1		1	
28.	*Nephrocytium Agardhianum* Näg.		2		1					1
29.	*N. limneticum* (G. M. Sm.) Skuja			2					2	1
30.	*N. varium* Hortob.					1		1		
31.	*Kirchneriella contorta* (Schmidle) Bohl.		1			1	1		1	1
32.	*K. contorta* var. *lunaris* Rich.	1	1	1	1	2	2	2	5	3
33.	*K. lunaris* (Kirchn.) Möb.		2	2		1	2		2	2
34.	*Selenastrum Bibraianum* Reinsch		1	1		2	3		3	3
35.	*Ankistrodesmus angustus* Bern.	1	1	1	1	1	2	2	3	3
36.	*A. arcuatus* Korsikov		2	2		1			2	2
37.	*A. falcatus* (Corda) Ralfs	1	2	2	1	2	2	1	2	2
38.	*A. pseudomirabilis* Korsikov		2	1		3	1		3	1
39.	*Coenocystis reniformis* Korsikov		1		2	1	1	1	4	1
40.	*Micractinium pusillum* Fresen	2	1		1					
41.	*M. quadrisetum* (Lemm. G. M. Sm.				1	2			1	
42.	*Dictyosphaerium pulchellum* Wood		2			1		1	2	1
43.	*Didymocystis bicellularis* (Chodat) Komarek					1			2	1
44.	*D. inermis* (Fott) Fott				1			1	1	
45.	*Coelastrum microporum* Nägeli	1	2	1		1	1		2	1
46.	*C. pseudomicroporum* Korsikov		1		1	3	1	1	2	1
47.	*C. sphaericum* Nägeli		1	1		2	1		1	1
48.	*Scenedesmus acuminatus* (Lagerh.) Chodat	1	2	1	2	3	2	1	3	1
49.	*Sc. acuminatus* var. *bernardii* (G. M. Sm.) Deduss.		1	1		1	1		1	1
50.	*Sc. acutus* Meyen		2	1		3	1		2	2
51.	*Sc. acutus* f. *costulatus* (Chod.) Uherkov.		1			2			1	1
52.	*Sc. apiculatus* (W. et G. S. West) Chodat					1	1			
53.	*Sc. bicaudatus* (Hansg.) Chodat	1	1	1	1	2	2	1	1	1
54.	*Sc. brevispina* (G. M. Smith) Chod.					2	1		1	
55.	*Sc. denticulatus* Lagerheim	1	2	2	1	3	2	1	3	2
56.	*Sc. dispar* Bréb.		1			2	1		1	1
57.	*Sc. ecornis* (Ralfs) Chodat		2	1		3	1		2	1
58.	*Sc. ecornis* var. *disciformis* Chodat		1	1	1	2	1		2	1
59.	*Sc. regularis* Swir.		1	1		2	2	1	3	2
60.	*Sc. quadricauda* (Turp.) Bréb.		1				2	1	1	1
61.	*Crucigenia apiculata* (Lemm.) Schmidle		1	1		3	2		2	1
62.	*Cr. rectangularis* (Nägeli) Gay		1			1	1		1	1
63.	*Cr. tetrapedia* (Kirchn.) W. et G. S. West	1	2	1	2	2	1	1	3	2
64.	*Cr. truncata* G. M. Sm.	1	1	1	1	1	1	1	2	1
65.	*Tetrastrum staurogeniaeforme* (Schröd.) Lemm.	1	2	1		2	1		2	1
66.	*T. staurogeniaeforme* f. *exaltatum* Hortob.					1			1	
67.	*Actinastrum Hantzschii* var. *fluviatitis* Schröd.		1	1		2	1	1	1	1
68.	*Pediastrum biradiatum* Meyen					1		1	1	
69.	*P. Boryanum* (Turp.) Memegh.		2	1	1	2			2	1
70.	*P. Boryanum* var. *longicorne* Reinsch		1			1	2	1	2	2
71.	*P. simplex* f. *duodenarium* (Bailey) Lemm.					1			1	
	Ordo: Ulothrichales, Siphonocladales									
72.	*Geminella interrupta* (Turp.) Lagerh.								1	2
73.	*G. ordinata* (W. u. G. S. West) Heering					1	2			

No	Species (taxon)	1976			1977			1978		
		a	b	c	a	b	c	a	b	c
74.	*Hormidiopsis* spec.		1	1		1	2		2	1
75.	*Cladophora fracta* KÜTZ. ampl. BRAND	2	3	3	2	3	3	3	4	3
	Classis: Conjugatophyceae									
76.	*Closterium ceratium* PERTY				1			1	2	
77.	*Cosmarium granatum* BRÉB.		1		1	2		1	2	
78.	*C. humile* (GAY.) NORDST.							1	1	
79.	*Straurastrum gracile* RALFS				1	1				
80.	*St. paradoxum* MEYEN				1	1		1		
81.	*Mougeotia virescens* (HASSALL) BORGE		2			3			2	

in 1935 (KISS 1939). Only the related Cyanophyta species exhibited certain tolerance of the agressivity of *Aphanizomenon*.

5. It is seen from the foregoing that the algae can well utilize organic materials. This is very important from the view of environmental protection. Certain groups of algae, species, moreover smaller physiological-biochemical units within the species are able to utilize also selectively and directly certain amino acids, carbohydrates, vitamins, plant hormones and other organic materials. Thus, saprobity and trophity are related with each other not only because the organic materials involved in the saprobity process increase trophity by their mineralization but also because the algae are able to incorporate some of these substances. This is of great significance in regard of algal indication.

Further studies are necessary in connection with the varied algal flora of the backwaters of the Tisza. In the beginning only some details of the algal flora were studied (PÁKH 1933, SZABADOS 1938, 1940). Hortobágyi was the first to perform a detailed explorative work, establishing the presence of 273 algal taxa in the Nagyfa backwater which is located near to Szeged (HORTOBÁGYI 1939). He complemented his results with further investigations, moreover, found also a marine brackish water algal species in the Nagyfa backwater, which in his opinion must have been introduced there by migrating birds (HORTOBÁGYI 1941a, 1941b, 1942). The first algological researches extended on the whole Hungarian section of the Tisza river were performed by UHERKOVICH (1971). He studied the algae of the Tisza in the saprobiontic system, the new and rare algal species of the Tisza and the algal flora of several backwaters both qualitatively and quantitatively (UHERKOVICH 1959 , 1961a, 1961b, 1963, 1967a, 1967b, 1971). Exploratory research work was carried out by Kiss in connection with the algal flora of some backwaters (KISS 1975, 1977a, 1977b, 1978a, 1978b, 1979). It would be both timely and useful from the aspect of basic research and environmental protection to perform comparative studies concerning the algae of the Tisza river, its backwaters and its tributaries.

References

HORTOBÁGYI, T. (1939): A Tisza „Nagyfa"-holtágának phytoplanktonja qualitatív vizsgálata (Qualitative Untersuchungen des Phytoplanktons des toten Armes "Nagyfa" der Tisza). — Folia Crypt. *2*, 151-216.

HORTOBÁGYI, T. (1941a): Újabb adatok a Tisza „Nagyfa"-holtága fitoplanktonjának kvalitatív vizsgálatához I (Neuere Beiträge zur qualitativen Untersuchung des Phytoplanktons im toten Theiss-Arme „Nagyfa" I). — Bot. Közlem. *38*, 151—170.

HORTOBÁGYI, T. (1941b): Tengeri moszat az Alföld planktonjában (Meeresalge im Ungarischen Tiefland). — Borbásia nova (Budapest) *5,* 1—2.

HORTOBÁGYI, T. (1942): Újabb adatok a Tisza Nagyfa-holtága fitoplanktonjának kvalitatív vizsgálatához II (Neuere Beiträge zur qualitativen Untersuchung des Phytoplanktons im toten Theiss-Arme „Nagyfa" II). — Bot. Közlem. *29,* 271—276.

KISS, I. (1939): Békés vármegye szikes vizeinek mikrovegetatioja. I. Orosháza és környéke (Die Mikrovegetation der Natrongewässer des Comit. Békés. I. Orosháza und dessen Umgebung). — Folia Crypt. *48,* 217—266.

KISS, I. (1951): Meteorobiológiai vizsgálatok a mikroszervezetek víz- és hóvirágzásában (Meteorobiological investigations of the water- and snow bloom of micro-organisms). — M. T. A. Biol. és Agrártud. Oszt. Közlem. *2,* 53—100.

KISS, I. (1952): Meteorobiologicseszkoe isszledovanije mikroorganizmov vizivajucsih cvetenie vodi i sznega). — Acta Biol. Acad. Sci. Hung. *3,* 159—220.

KISS, I. (1970): A Kakasszéki szikes tó mikrovegetációja (Die Mikrovegetetion des Natronsees bei Kakasszék). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 55—94.

KISS, I. (1975): Mass-production occurrence of the *Botrydium* species in the inundation areas of the Tisza and Maros in the environs of Szeged. — Tiscia (Szeged) *10,* 39—44.

KISS, I. (1976): Magyarország szikes tavaiban végzett hidrológiai és algológiai vizsgálataim áttekintése (Der Durchblick meiner hidrologischen und algologischen Untersuchungen, die in den alkalischer Teichen von Ungarn gemacht wurden). Juhász Gy. Tanárk. Főisk. Tud. Közlem. *2,* 51—69.

KISS, I. (1977a): Investigation of the water blooms of *Eudorina elegans* in the dead-arm of the river Tisza at the community Mártély. — Tiscia (Szeged) *12,* 37—47.

KISS, I. (1977b): Variability of *Scenedesmus ecornis* (RALFS) CHOD. in the dead-arm of the river Tisza at Körtvélyes. — Tiscia (Szeged) *12,* 49—57.

KISS, I. (1978a): Algological investigations in the dead-Tisza at Lakitelek—Tőserdő. — Tiscia (Szeged) *13,* 27—47.

KISS, I. (1978b): Occurance of *Synura uvella* EHR. var. *Tiszaensis* n. var. in the dead arm of the river Tisza near Lakitelek. — Tiscia (Szeged) *13,* 49—54.

KISS, I. (1979): Seltene Strombomonas-Arten aus den toten Armen der Tisza (Theiss) am mittleren und oberen Flusslauf. — Tiscia (Szeged) *14,* 63—70.

PÁKH, E. (1933): Daten zur Mikrovegetation des Szentmihályteleker toten Tisza-Armes. — Acta Biol. Szeged *2,* 233—266.

RAPAICS, R. (1925): A növények társadalma (Die Gesellschaft der Pflanzen). — Budapest.

SZABADOS, M. (1938): Szentmihálytelek „Holt Tisza"-ágának Flagellata-vegetációja I (Flagellaten-Vegetation der „Holt-Tisza" bei Szentmihálytelek I). — Bot. Közlem. *36,* 107—119.

SZABADOS, M. (1940): Szentmihálytelek „Holt Tisza"-ága Flagellata és Volvocales vegetációja II (Flagellaten- und Volvocales-Vegetation der „Holt Tisza" bei Szentmihálytelek II). — Bot. Közlem. *37,* 48—65.

UHERKOVICH, G. (1959): Adatok a Tisza-holtágainak mikrovegetációjához. A szolnoki Tiszaholtágainak algái 1957 őszén (Beiträge zur Kenntnis der Algenvegetation der Tisza-(Theiss) Altwässer I. Die Algen der szolnoker „Toten Tiszaarmes" im Herbst 1957). — Bot. Közlem. *48,* 30—40.

UHERKOVICH, G. (1961a): Tiszai algák a szaprobionta rendszerben (Algen of the Tisza river in the saprobionte System). — Hidrol. Közlem. *41,* 85—88.

UHERKOVICH, G. (1961b): Das Leben der Tisza XIV. Ergänzende Beiträge zur Kenntnis der Algenvegetetion des Szolnoker Tisza-Altwassers. — Acta Biol. Szeged *7,* 89—94.

UHERKOVICH, G. (1963): Adatok a Tisza holtágainak mikrovegetációjához II. A szolnoki Holt-Tisza fitoplanktonjának mennyiségi viszonyai (Daten zur Mikrovegetation der Tisza Altwässer II. Quantitative Verhältnisse des Phytoplanktons der szolnoker Toten Tisza). — Bot. Közlem. *50,* 117—124.

UHERKOVICH, G. (1967a): Neue und seltene Algen aus der Theiss (Tisza) und zwei Altwässern der Theiss. — Tiscia (Szeged) *3,* 3—11.

UHERKOVICH, G. (1967b): Über das Sommerplankton des Altwassers von Mártély. — Tiscia (Szeged) *3,* 13—20.

UHERKOVICH, G. (1971): A Tisza lebegő paránynövényei. (A Tisza fitoszesztonja)- Die Mikrophyten in der Trift des Fluesses Theiss (Tisza) (Das Phytoseston der Theiss). — Damjanich J. Múz. (Szolnok) *20—22,* 1—282.

VÄLIKANGAS, I. (1922): Eine von *Euglena viridis* EHRENB. hervorgerufene Vegetationsfärbung des Eises im Hafengebiet von Helsingfors. — Översikt av Finska Vetenskaps-Soc. Förhandlingar *64,* 1—22.

Szezonális, edáfikus és biotikus tényezők szerepe a cibakházai holtág algatársulásainak kialakulásában

Kiss I.

Tiszakutató Munkacsoport Szeged, Magyarország

Kivonat

Az értekezés a Cibakháza melletti Holt-Tiszából összesen 215 algataxont közöl. A 3 éven át folytatott munka az algatársulások kialakulásának szezonális, edáfikus és biotikus tényezőinek feltárására is irányult. A táblázat szerint az algavilág kvalitativ és kvantitatív szempontból nyáron a leggazdagabb. Az edáfikus tényezők társulásformáló hatása a felvehető és testbe építhető anyagokon alapszik, a biotikus tényezők pedig a „tűrés" és „kedvelés", valamint a szinergizmus és antagonizmus ellentéteiből adódnak. A vízvirágzások kialakulásában a szervestrágyával való nyeződés a legdöntőbb, s rámutat: a szaprobitás és a trofitás nemcsak a szervesanyagok mineralizálódásával függnek össze, hanem úgy is, hogy az algák szelektív módon organikus vegyületeket is hasznosítanak. Ez az alga-indikáció kérdését alapjaiban érinti, s ezen keresztül igen jelentős a környezetvédelem szempontjából is.

Uticaj sezonskih, edafskih i biotičkih faktora na razvoj zajednica algi u mrtvaji Cibakháza

Kiss I.

Radna grupa za istraživanje reke Tise, Szeged, Hungaria

Abstrakt

U radu je ukupno prikazano 215 taksona algi iz mrtve Tise kod Cibakháza. Torgodišnji rad ukazuje i na uticaj sezonskih, edafskih i biotičkih faktora na razvoj zajednica algi. Svet algi je najbogatiji kako u kvalitativnom tako i u kvantitativnom pogledu u toku leta. Uticaj edafskih faktora na formiranje zajednice se zasniva na materijama koje se mogu uzimati i ugraditi u telo. Biotički faktori se javljaju u smislu podnošljivosti , a takodje proizilaze i iz suprotnosti sinergizma i antagonizma. Zagadjivanje organskim djubrivima je najodlučujući faktor u pojavljivanju cvetanja vode i ukazuje na činjenicu da saprobnost i trofičnost nije u zavisnosti samo od mineralizacije organskih materija, već i od činjenice da alge selektivnim putem koriste i organska jedinjenja. Ova činjenica u osnovi zadire i u pitanje algi kao indikatora, i od značaja je i u pogledu zaštite životne sredine.

РОЛЬ СЕЗОННЫХ, ЭДАФИЧЕСКИХ И БИОЛОГИЧЕСКИХ ФАКТОРОВ ПРИ ФОРМИРОВАНИИ ВОДОРОСЛЕВЫХ СООБЩЕСТВ В ЦИБАКХАЗСКОЙ СТАРИЦЕ

И. Кишш

Рабочая группа изучения реки Тисы
Сегед, ВНР

Резюме

В работе описаны 215 таксонов водорослей из старицы Тисы расположенной вблизи С. Цибакхаза. В течении 3-х лет направление работы велось на раскрытие сезонных, эдафических, биотических факторов образований водорослевых сообществ.

Приведенные в таблице данные показывают на то, что мир водорослей, как и квалитативно являются самым большим богатством этого места летом. Влияние эдафических факторов

при образовании сообществ водорослей закладывается на основании образующихся веществ в организме водорослей, а биотические факторы закладываются на «терпении» и «желании», а также на синергизме и антагонизме. При формировании цветения воды, наиболее решающим является загрязнение воды органическими удобрениями, что говорит о том, что сапрофитизм и трофитизм зависимы не только от минерализации органических веществ, но и о том, что водоросли путем селективных обособленностей используют и органические соединения. Это, в основном, касается вопросов индикаторов водорослей, что является очень важным моментом с точки зрения охраны природы.

Tiscia (Szeged) Vol, XVIII, pp. 47—52 (1983)

CHARACTERISTIC PHYTOPLANKTON COMMUNITIES IN THE DAMMED UP SECTION OF THE TISZA RIVER AND IN THE EASTERN MAIN CANAL

K. T. KISS

Hungarian Danube Research Station of the Hungarian Academy os Sciences
Göd, Hungary
(Received October 15, 1981)

Abstract

Studies on the dammed up section of Tisza at Tiszalök and on the Eastern Main Canal revealed that the quantitative composition of phytoplankton was essentially different between consecutive years, exhibiting changes even within the same year. It often occurred that in a few weeks such phytoplankton communities appeared in the water which were practically different from the previous one. It emerged the question as to which phytoplankton communities appearing temporarily in similar composition are characteristic of the above mentioned waters.

To settle this question, the constancies (C) of taxons in the single samples were determined. The results of examinations at each given sampling place and in each given period were regarded as a community survey.

The analyses showed that from 1968 to 1979 phytoplankton communities in the dammed up section of the Tisza at Tiszalök and in the Eastern Main Canal could be ranged into the same basic type in periods of mass vegetation. The constant and dominant presence of *Stephanodiscus hantzschii* GRUN. and the constant presence of some species of the order Chlorococcales were characteristic of this type. Some sub-types of this basic mass vegetation type were also observed.

Introduction

According to HUTCHINSON (1967) the phytoplankton community observed in a particular time of sampling should be regarded as an association, and named after the dominant species (this applies to the phytoplankton of lakes). In connection with that a program was proposed by FELFÖLDY (1981) for future investigations: "Besides recognition, delimitation and systematization such elementary questions should also be settled by the investigators of phytoplankton whether communities occurring in the same place but changing seasonally should be regarded as associations according to seasons each or only the change of aspect of the same association". Concerning the plankton communities of rivers he claims that we know so little of them that we cannot even try to systematize them.

In Hungary UHERKOVICH described such phytoplankton communities in the Tisza, which he regarded as typical ones. Such were the mass vegetations characterized by the dominance of *Melosira granulata* var. *angustissima* MÜLL. — *M. granulata* var. *angustissima* f. *spiralis* HUST., resp. *Cyclotella* — *Nitzschia actinastroides* (LEMM.) v. GOOR, and *Cyclotella* — *Aphanizomenon flos-aquae* (L.) RALFS (UHERKOVICH 1968 a, b, 1969 a, 1971). On the basis of comparison with other streams he claims that the general phytoplankton of the Tisza is a *Cyclotella* — *Nitzschia aci-*

cularis W. SMITH — *Synedra ulna* (NITZSCH.) EHRBG. — *Scenedesmus* community, that of the Danube a *Cyclotella* — *Nitzschia acicularis* W. SMITH — *Synedra acus* KÜTZ. — *Actinastrum Hantzschii* LAGH. community, and that of the Drava a *Ceratoneis arcus* KÜTZ. — *Cyclotella* — *Diatoma vulgare* BORY — *Synedra ulna* (NITZSCH.) EHRBG. one (UHERKOVICH 1969 b, 1971).

Sampling and Methods

The Eastern Main Canal is a canal led out from the reservoir of the river barrage of Tiszalök. Its water flow is regulated with sluices, its flow volume in irrigation periods is 35—40 m^3/sec, the width of its water surface 40 m, its depth 3—4 m, its length 98 km (Fig. 1).

Places of water sampling were: 1 — Tiszalök (0.4 riv km), 2 — Tiszavasvári (4.7 riv km), 3 — Balmazújváros (44.5 riv km). From 1968 to 1975, water samples were taken weekly, from 1976 to 1979 on occasions from the Eastern Main Canal from below the water surface, from the main current. Care was taken to collect the samples from the same mass of water (UHERKOVICH 1968 b). Therefore, by taking into accout the actual flow rate of water, the water of the canal at Balmazújváros was sampled 2—7 days later relative to the samplings at Tiszalök, Tiszavasvári.

The quantitative examination of phytoplankton communities was made by Utermöhl's method (UTERMÖHL 1958). The characteristic phytoplankton communities were separated from one another on the basis of the constancies of species. Constancies were interpreted according to KÁRPÁTI and TERPÓ (1971), as follows: The results of examinations on samples from each point of sampling in the Eastern Main Canal and collected in the single periods were regarded as a community survey, and these were compared. The degree of constancy shows in which percentage a particular taxon occurred in the samples:

5 = 81 – 100%
4 = 61 – 80%
3 = 41 – 60%
2 = 21 – 40%
1 = 1 – 20%

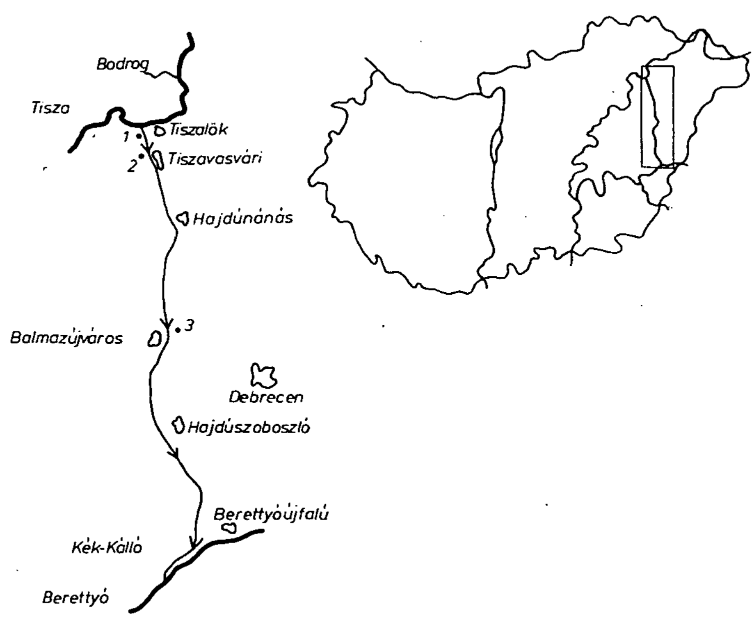


Fig. 1. Sketchy map of Hungary and the Eastern Main Canal.

Table 1. *Quantitative relations of phytoplankton in periods of characteristic mass vegetation*

Place of sampling	1	2	3	1	2	3	1	2	3	3
	1972			1972			1975			1979
Time of sampling	7.6	7.6	9. 6	21. 6	21. 6	23. 6	10. 9	10. 9	12. 9	9. 3
Achnantes minutissima KÜTZ.										25
Asterionella formosa HÁSS.								25	5	25
Cyclotella kuetzingiana THWAITES	650	610	360	25	20	30	50	65	20	
C. meneghiniana KÜTZ.	800	810	550	10	15	25	95	110	25	320
Melosira distans (EHRBG.) KÜTZ.	45	50	10				10	10	5	
M. granulata var. *angustissima* MÜLL.						12		25	20	
Nitzschia acicularis W. SMITH	900	550	325	50	40	225	63	50	50	
N. actinastroides (LEMN.) v. GOOR	25	25	75	1225	1200	1200				
Stephanodiscus hantzschii GRUN.	16,200	13,830	3080	330	180	395	1120	1925	480	9,055
Surirella ovata KÜTZ.										25
Synedra acus KÜTZ.			75				12			
S. ulna (NITZSCH.) EHRBG.					12			12	15	
Pennaies spp.		100	120	15	63	38		13	95	75
Bacillariophyceae:	18,620	15,975	4595	1655	1530	1925	1350	2235	715	10,225
Actinastrum hantzschii LAG.	75	75	325				15	50	10	
Ankistrodesmus acicularis (A. BR.) KORS.	100	125	75		12			10		
A. angustus BERN.	600	500	1025	288	238	400	10	50	20	10
A. arcuatus KCRS							15			
A. longissimus var. *acicularis* (CHOD.) BRUNNT.	150	150	175						5	75
A. minutissimus KORS.								10		
Chlorella vulgaris BEIJER.	195	220	200	70	85	125				75
Chodatella quadriseta LEMM.			25							
Coelastrum microporum NAEG.	25	50	100		12	38				
C. sphaericum NAEG.				12	13	12		10		
Crucigenia tetrapedia (KIRCH.) W. et G. S. WEST					12	12	175	115	20	
Dictyosphaerium pulchellum WOOD	175	150	125			13				
Didymocystis planctonica KORS.	25	25		25	25	38				
D. tuberculata KORS.		25		12	38					
Kirchneriella lunaris (KIRCH.) MÖB.	25	50	50	38	140	300	25	10	5	
K. obesa (W. West) SCHMIDLE	15	15	10	20	40	45				
Micractinium pusillum TRES.			25							
Nephrochlamys subsolitaria (G. S. WEST) KORS.	10	10	15	18	22	43				
Oocystis borgei SNOW.	50			12	13	12		15		
Pediastrum boryanum (TURP.) MENEGH.							40	50		
P. tetras (EHRBG.) RALFS						12				
Scenedesmus acuminatus (LAG.) CHOD.	300	300	50					5		
S. acutus MEYEN	200	50	25						10	
S. ecornis (RALFS) CHOD.	25	25								
S. intermedius CHOD.	100		25	12	12					
S. opoliensis P. RICHT.					13					
S. quadricauda CHOD.	150	225	100	300	75	75		15		
S. spinosus CHOD.	25	50	10	45	10		15	15		
Scenedesmus spp. :	50	50	15	20	50	50	45	50	5	
Schroederia setigera (SCHROED.) LEMM.		75								10
Tetraedron caudatum (CORDA) HANSG.		25				12				
T. incus (TEIL.) G. M. SMITH		25	50	20		13				
T. minimum (A. BR.) HANSG.			50				5		5	
T. muticum (A. BR.) HANSG.	25		75		12					
Tetrastrum glabrum (ROLL) AHLSTR. et TIFF.		25	50	12	13	50	25	65		
T. staurogeniaeforme (SCHROED.) LEMM.				13	13		25	35	5	
Treubaria triappendiculata BERN.	50	25	50	12	12					
Chlorococcales spp.	130	180	75	21	65	100	15		10	75
Chlorococcales:	2,500	2,450	2725	950	925	1350	410	505	95	245
Aphanizomenon flos-aquae (L.) RALFS							675	200		
Merismopedia glauca (EHRBG.) NAEG.	10									
Microcystis flos-aquae (WITTR.) KIRCH.		20	25							
Cyanophyta spp.	75	75				38	25			
Euglena spp.			10		12	12	50	75		
Strombomonas fluviatilis (LEMM.) DEFL.	5			15			40	15		
Trachelomonas volvocina EHRBG.					13					20
Chroomonas acuta UTERM.							10		5	25
Cryptomonas erosa EHRBG.							20		10	75
C. marssonii SKUJA										20
C. ovata EHRBG.							55	15	20	
Peridium sp.					15					
Dinobryon sertularia EHRBG.			25							
Mallomonas sp.										20
Chlamydomonas spp.	150	50	25		35	15		25		330
Staurastrum paradoxum MEYEN								15		
Total number of algae in ind./lit.	21,360	18,570	7405	2620	2530	3340	2635	3085	845	10,960

Results

The quantitative phytoplankton studies carried out for many years in the dammed up reach of the Tisza at Tiszalök and in the Eastern Main Canal shoved that under suitable ecological conditions the density of phytoplankton communities could be as high as several million individuals per liter. If the Tisza was not flooding, the velocity of water flow in the Eastern Main Canal was little, the suspended mineral materials settled out, and the water became transparent. With the developing of a favourable light climate in the water the growth rate of phytoplankton organisms increased rapidly. Since in the Tisza and in the Eastern Main Canal the water was amply supplied with plant nutrients, there was no nutrient limitation. Temperature did not essentially influence the quantitative composition of phytoplankton communities, and mass vegetations could develop within a few days.

As soon as the ice began to melt, opportunity was offered for the developing of phytoplankton mass vegetation. In such times *Stephanodiscus hantzschii* GRUN. dominated in the phytoplankton. The individual numbers of other species were insignificant. Such a mass vegetation was observed on one occasion in the dammed up reach of the Tisza at Tiszalök in the first days of February, 1972 (for more details see KISS, K. T. 1975). Similar mass vegetations developed, however, each year in the Balmazújváros section of the Eastern Main Canal. To exemplify this, the quantitative data of the mass vegetation of March 9, 1979 are presented in Table 1.

In high-water periods during spring and early summer, individual numbers were small in the phytoplankton of the Tisza and in the Eastern Main Canal (100—500 thousand ind./lit). From the end of May to the end of October, besides the slow flow rate of water in flood-devoid periods, and favourable light conditions mass vegetation of plankton algae occurred more than once in one year (see for details: KISS, K. T. 1974 a, b, KISS, K. T. and SZABÓ 1975). Examples are presented in Table 1 for the illustration of phytoplankton communities of high individual and species number.

The phytoplankton mass vegetations of consecutive years showed essential differences in regard of their quantitative composition (individual numbers ranged from 1—2 million to 20—21 million in one liter water). Because of that they often appeared completely different and difficult to compare.

Though the plankton algal communities of mass vegetations exhibited essential differences quantitatively, they were fairly similar in respect of species composition. In the comparison of phytoplankton communities the frequency of a species determined on the basis of its constancy values is thought to be more essential than the individual number per liter of the particular species.

104 phytoplankton communities were analyzed for constancy. On the basis of their dominant species, these communities were ranged into four groups. In each group 27, 27, 15 resp. 35 samples were analyzed (Table 2).

Values for constancy showed that during these studies phytoplankton mass vegetation in the dammed up section of the Tisza at Tiszalök and in the Eastern Main Canal was of the same type in respect of its basic properties. This phytoplankton community was characterized by the dominance of *Stephanodiscus hantzschii* GRUN. (constancy 5) and the appearance of some species (with a constancy of 3—5 each) of the order Chlorococcales (column 1, Table 2). In the algal group with 3—5 constancy, there were 5 diatoms and 24 taxa belonging to Chlorococcales. This phytoplankton community was regarded as the basic type of the mass vegetation during

Table 2. *Constancies of species of phytoplankton mass vegetation types*

Type of mass vegetation	S—Ch	S-Ch-N	S-Ch-A	S
Number of analysed samples	27	27	15	35
Stephanodiscus hatzschii GRUN.	5	5	5	5
Ankistrodesmus acicularis (A. BR.) KORS	5	4	2	2
A. angustus BERN.	5	5	5	3
Chlorella vulgaris BEIJER	5	4	3	2
Oocystis borgei SNOW.	5	4	3	1
Scenedesmus quadricauda CHOD.	5	5	4	1
Cyclotella Kuetzingiana THWAITES	4	4	4	1
C. meneghiniana KÜTZ.	4	4	3	1
Nitzschia acicularis W. SMITH	4	3	4	2
Actinastrum hantzschii LAG.	4	3	3	1
Ankistrodesmus longissimus var. *acicularis* (CHOD.) BRUNNT.	4	2	3	3
Crucigenia terapedia (KIRCH) W. et G. S. WEST	4	4	5	1
Didymocystis planctonica KORS.	4	3	4	
Nephrochlamys subsolitaria (G. S. WEST) KORS.	4	3	2	
Scenedesmus acuminatus (LAG.) CHOD.	4	3	3	
S. acutus MEYEN	4	2	2	
Tetrastrum glabrum (ROLL) AHLSTR. et TIFF.	4	2	3	1
Nitzschia actinastroides (LEMM.) v. GOOR	3	5	3	
Ankistrodesmus arcuatus KORS.	3	2	2	
A. minutissimus KORS.	3	3	3	1
Coelastrum microporum NAEG.	3	2	3	1
Crucigenia apiculata (LEMM.) SCHMIDLE	3	2	4	
Dictyosphaerium pulchellum WOOD	3	2	2	
Didymocystis tuberculata KORS.	3	1	2	
Kirchneriella lunaris (KIRCH.) MÖB.	3	3	3	1
Scenedesmus intermedius CHOD.	3	3	2	1
Schroederia setigera (SCHROED.) LEMM.	3	1	1	1
Tetrastrum staurogeniaeforme (SCHROED.) LEMM.	3	1	1	
Treubaria triappendiculata BERN.	3	1	1	
Melosira granulata var. *angustissima* MÜLL.	2	3	3	
Micractinium pusillum TRES.	2	3	2	
Asterionella formosa HASS.	1	1	3	3
Aphanizomenon flos-aquae (L.) RALFS	1	1	5	

Explanation: S—Ch — *Stephanodiscus hantzschii* GRUN. — *Chlorococcales* S—Ch—N — *Stephanodiscus hantzschii* GRUN. — *Chlorococcales* — *Nitzschia actinastroides* (LEMM.) v. GOOR, S—Ch—A — *Stephanodiscus hantzschii* GRUN. — *Chlorococcales* — *Aphanizomenon flos-aquae* (L.) RALFS, S — Mass vegetation with the dominance of *Stephanodiscus hantzschii* GRUN. In the table those species are listed which posses at least a constancy of 3 in some mass vegetation type.

these studies. It was temporarily replaced by one of its subtypes, which were the following ones:

1. Phytoplankton community of which the presence of *Stephanodiscus hantzschii* GRUN. — *Chlorococcales* — *Nitzschia actinastroides* (LEMM.) v. GORR was characteristic. The main features of this phytoplankton mass vegetation and those of the basic type were the same. However, the individual numbers of *Nitzschia actinastroides* (LEMM.) v. GORR were occasionally of the order of a million making up 70—80% of the phytoplankton.

2. A phytoplankton community of which the constant presence of *Stephanodiscus hantzschii* GRUN. — *Chlorococcales* — *Aphanizomenon flos-aquae* (L.) RALFS was characteristic. In the basic type of the mass vegetation the constancy of *Aphanizo-*

menon flos-aquae (L.) RALFS was 1., its individual number being of the order of thousand, ten thousand per liter. In certain times, particularly in late summer, constancy values increased to 5, individual numbers even attaining the order of 100 000, moreover the number of trichomes increased to 1.000,000 lit^{-1}. It became a dominant member of the phytoplankton.

3. A phytoplankton community characterizable by the constant presence of *Stephanodiscus hantzschii* GRUN. The mass vegetation in late winter and early spring was very similar to the aforementioned basic type in that the constancy of *Stephanodiscus hantzschii* GRUN was 5. Its individual number was of the order of a million. It was dominant member of the phytoplankton. Beside it with lower constancy values and smaller individual numbers several taxa characteristic of the basic type also occurred.

The transition between the basic type and the three subtypes each was continuous. Species frequently appearing in the samples often occurred in great numbers and became perhaps dominant. Constancies were however even then similar to those of the basic type. Phytoplankton communities occurring in the dammed up section of the Tisza at Tiszalök and in the Eastern Main Canal in great individual numbers are not regarded as associations, or the varieties of their aspect. Further studies are necessary to decide whether the concepts association, aspect can be also used in the case of the phytoplankton communities of rivers. The characteristic phytoplankton mass vegetations which develop, occur and float away in the above streams, and which are made up of euplanktonic algae are considered to be and are named plankton algal communities of similar constancy.

References

FELFÖLDY, L. (1981): Ecology of waters. General hydrobiology (in Hungarian only). Publishing House of Agriculture, Budapest.

HUTCHINSON, G. E. (1967): A treatise on limnology. Vol. II. Introduction to lake biology and the limnoplankton. — New York. J. Wiley and Sons, Inc. p.: 1—1115.

KÁRPÁTI, Z. and TERPÓ, A. (1971): Applied plant geography (in Hungarian only). — Budapest. Publishing House of Agriculture Budapest.

KISS, K. T. (1974 a): Effect of the turbidity of the water on the development of algal associations in the Tisza. — Tiscia (Szeged) *9*, 9—24.

KISS, K. T. (1974 b): Studies on the water of the Eastern Main Canal II. Quantitative changes of phytoplankton (in Hungarian). — Hidrol. Közlem. *54*, 406—416.

KISS, K. T. (1975): Ecological factors affecting *Cyclotella* overproduction in the Eastern Main Canal and the Tisza River in Hungary. — Acta Biol. Debrecina *12*, 135—144.

KISS, K. T. and SZABÓ, A. (1975): Longitudinal profile investigation in the Tisza and Eastern Main Channel I. Quantitative changes in phytoplankton. — Tiscia (Szeged) *10*, 3—14.

UHERKOVICH, G. (1968 a): Data to the knowledge of the potamophytoplankton of the Tisza, VI. To the question of the development of population maxima (in Hungarian). — Hidrol. Közlem. *48*, 315—322.

UHERKOVICH, G. (1968 b): Über verschiedene Typen der Algenmassenvermehrung in der Tisza (Theiss). — Tiscia (Szeged) *4*, 11—20.

UHERKOVICH, G. (1969 a): Data to the knowledge of the potamophytoplankton of the Tisza. VII. Special forms of population maxima (in Hungarian). — Hidrol. Közl. *49*, 31—35.

UHERKOVICH, G. (1969 b): Über die quantitativen Verhältnisse des Phytosestons (Phytoplanktons) der Donau, Drau, Theiss. — Acta Bot. Hung. *15*, 183—200.

UHERKOVICH, G. (1971): The phytoseston of the Tisza (in Hungarian). — Szolnok Megyei Múzeumi Adattár. *20—22*, 1—282.

UTERMÖHL, H. (1958): Zur Vervollkommnung der quantitatiaen Phytoplankton-Methodik. — Mitt. Int. Ver. Limnol. *9*, 1—38.

Jellegzetes fitoplankton együttesek a Tiszán és a Keleti Főcsatornán

Kiss K. T.

Magyar Dunakutató Állomás, Göd, Magyarország

Kivonat

A Tisza tiszalöki visszaduzzasztott mederszakasza és a Keleti Főcsatorna planktonalga vizsgálata során szembetűnő, hogy az egymást követő években s egy éven belül is a fitoplankton mennyiségi viszonyai jelentősen különböznek egymástól. Gyakran néhány héten belül is, szinte merőben eltérő planktonalga együttesek jelennek meg a vízben. Felvetődik a kérdés, hogy vannak-saját jellegzetes, időszakonként hasonló összetételű fitoplankton együttesei a fenti folyóvizeknek vagy n≦ncsenek"

Az elemzéseket követően megállapítható volt, hogy 1968—79 között a Tisza tiszalöki, visszaduzzasztott mederszakaszának és a Keleti Főcsatornának fitoplankton együttesei, a tömeg *Stephanodiscus hantzschii* Grun. konstans és domináns, valamint a Chlorococcales rend egyes fajainak konstans jelenléte jellemző. Ennek a tömegvegetáció alaptípusnak bizonyos altípusai is megfigyelhetők.

Karakteristične fitoplanktonske zajednice Tise i Istočnog glavnog kanala

Kiss K. T.

Stanica za istraživanje Dunava Madjarske, Göd, Hungaria

Abstrakt

Pri istraživanjime planktonskih algi u akumulaciji reke Tise i Istočnog glavnog kanala kod Tiszalök-a, uočljivo je da se kvantitativni odnosi fitoplanktona, kako iz godine u godinu, tako i u toku jedne godine znatno razlikuju. Često i u toku nekoliko nedelja dolazi do pojave veoma različitih fitoplanktinskih zajednica. Postavlja se pitanje, postoje li svojstvene i specifične, i po sastavu sezonski slične fitoplanktonske zajednice u navedenim teku°im vodama, ili ne"

Na osnovu izvršsenih analiza utvrdjeno je da u periodu 1968—1979. godine fitoplanktonske zajednice u naznačenom regionu Tise i Istočnog glavnog kanala, u toku njihove masovne pojave, spadaju u isti osnovni tip. Ovo karakteriše konstantno i dominantno prisustvo Stephanodiscus hantzschii Grun., a takodje i konstantno prisustvo odredjenih vrsta iz reda Chlorococcales. Takodje su uočene unutar osnovnog tipa masovne fitoplanktonske vegetacije i postokanje odredjenih podtipova.

ХАРАКТЕРНЫЕ ФИТОПЛАНКТОННЫЕ ГРУППЫ НА ТИССЕ И НА ВОСТОЧНОМ ГЛАВНОМ КАНАЛЕ

К. Т. КИШ

Венгерская дунайская опытная станция Гёд, Венгрия

В ходе исследования планктонных водорослей в запружённом участке русла Тиссы у Тиссалёка и Восточного главного канала обращает на себя внимание тот факт, что количественные отношения фитопланктона значительно отличаются друг от друга не только из года в год, но и в течение одного года. Часто даже в течение нескольких недель в воде наблюдаются почти совершенно различные группы планктонных водорослей. Возникает вопрос: существуют ли характерные, свойственные указанным выше текучим водам периодически сходные группы фитопланктона?

Анализы подтвердили, что группы фитопланктона в запружённом участке русла Тиссы и Восточного главного канала в период между 1968—1979 годами характеризируются массовым и константным доминантны и наличием Stephanodiscus hantzschii Grun. а также константным наличием некоторых пород отряда Chlorococcales. Кроме того наблюдаются некоторые подтипы этой основной массовой вегетации.

Tiscia (Szeged) Vol. XVIII, pp. 53—57 (1983)

В ВЕРХОВЬЯХ РЕКИ ТИСА

Фодор С. С., Комендар В. И., Щербань М. И., Дудинский Т. Т.

Уровень производительности юго-западных склонов Советских Карпат сосредоточен сосредоточен в бассейне реки Тисы и его притоках. Это определяет значение реки в народном хозяйстве. Но река и его речная система давала знать о себе не только своими благотворными действиями. Наводнение реки на протяжении многих столетий беспокоило население в ее долинах. Но только в последнем десятилетии изменилось все к лучшему, когда начали заниматься регуллировкой течения и постройкой дамб. Тиса на воздвинутые высокие дамбы отвечала еще большими наводнениями. Это принуждало человека строит все новые и все высшие дамбы.

Во всем этом виновен человек, а не Тиса. Ведь издавна густые леса и пышная растительность Карпат, как губка впитывала в себя осадки, которые превращаясь в грунтовые воды, равномерно стекали в притоки и в русло реки Тисы.

Думая о прошлом, спрашиваем себя: почему сегодня человек должен расходовать такие большие средства для покорения Тисы?

Нарушив законы природы, человек нарушил равновесие между живой и неживой природой, а для восстановления этого равновесия должен опять и опять вмешиваться. В прошлом во время переселения, народы уничтожали растительность Карпатских хребтов. Выпасанием скота препятствовали его возобновления. В связи с тем в настоящее время атмосферные осадки без препятствий несут с собой со склонов гор в реки песчаники, гальки, гумусы, мелкозем. И так, склоны гор со временем становятся менее продуктивными, а долины от этого не стают богаче. Ведь растворенные минеральные частицы вместе с быстрыми ручьями попадают в Тису, которая несет их в сторону моря.

С целью повышения урожайности сельскохозяйственных культур все больш вносим минеральных удобрений в почву. При внесении больших доз минеральных солей в почву, часть их смывается дождем, что ведет к загрязнению воды. Частые проливные дожди в горах не дают возможность корням растений удобрений. Большое количество растворенны хминеральных поглощать даже самое меньшое количество легкорастворимых минеральных солей и наносов приводит к сильному загрязнению воды в Тисе.

Занашиванию русла реки Тиса большим количеством наносов в настоящее время навряд ли может человек воспрепятствовать. Ведь исток Черной Тисы находится на высоте 1680 метров над уровнрм моря. А ниже, на расстоянии 265 км, возле г. Чопа, высота реки находится только 105 метров над уровнем моря. Таким образом, внезапное превращение быстроводной горной реки в низменную с медленным течением, сопровождается большим естественным образованием отложений. Русло реки в результате наносов поднимается, поэтому и дамбы должны быть высими. Если количество наносов будет увеличиваться и дальше, то может наступить время, когда дно Тисы поднимется высше уровня берегов. Это грозит той опасностью, что во время сильного наводнения могут быть залиты большие земельные участки, которые раньше не относились к заливным территориям.

Как у нас в Советском Союзе, так и в ВНР все больше и больше средств расстрачивается на обуздание реки Тисы — поднятием в высоту дамб, уменьшение скорости течения реки и др. .Однако эти мероприятия не приводят к уменьшению наносов в реке. Большое количество осадков, таяния снега влекут за собой все больше и больше отложений в русле реки. Чем больше воды, тем больше и наносов. Если скорость течения Тисы за секунду возле г. Хуста становит 35 м , то возле Чопа уже 45 $м^3$, а возле Солнока (ВНР) — 200 $м^3$. Этим объясняется то, что вопреки регуляции реки, уровень наводнения Тисы за последнюю половину столетия возле г. Хуста поднялся на 0.8 метров, возле г. Чопа — I метр, а возле г. Солнока даже на 2,5 метра.

Для защиты от наводнения реки Тиса имеются разные способы. Один из главнейших — является торможение скорости течения реки, что может привести к сокращению образования наносов. Однако для этого необходимо построить на отдельных участках реки водные перекрытия, что приведет к образованию водохранилища.

Разлив реки Тиса занимает большую территорию, при чем преимущественно это высокоурожайные сельскохозяйственные угодия. Поэтому важной задачей следует считать защиту от наводнения площадей заливных территорий реки Тисы. Однако предпринимаемые меры могут быть безуспешными, если р. Тиса и в дальнейшем будет загрязняться.

В нашей области предпринято ряд мер, чтоб избежать попадания промышленных стоков из населенных пунктов в реку. Однако построенные до сих пор фильтрующие сооружения способны очистить только часть загрязненных сточных вод.

Кроме того, дождевые воды, которые накопляются в городских водосточных каналах, почти невозможно очистить. А ведь дождь своими водами с дорог смывает множество химических веществ, солей и масел.

Загрязнение воды влияет и на развитие животного мира реки. Тиса, которая еще недавно была так богата рыбными запасами, чего нельзя утверждать в настоящее время.

В настоящее время следует принять ряд мер относительно регуляции реки — защитить ее от наводнений и сохранить в Тисе чистотй воды. Следует также предпринять более эффективные меры относительно устранения причин порождающих наводнения и ускоренное образование водных наносов.

Мнение биологов Ужгородского госунивермитета единодушно сводятся к тому, что повторные наводнения реки Тисы происходят от прямого, быстрого истекания атмосферических осадков с горных склонов в реку. Воспрепятствовать которому возможно только на горных склонах путями торможения стока этих вод. Осуществляя эти задачи следует отказаться от традиционного вертикального вспахивания почвы на крутых горных склонах. Искусственные удобрения следует внести в этих местах более глубоко в почву (чтоб вода их не сносила). Научно экспериментальные исследования показали результативность и влиятельность этих методов.

Не менее результативными являются исследования проводимые учеными кафедры ботаники УжГУна горе Полонины Ровная по восстановлению леса при верхней лесней границе в высокогорном поясе.

Посаженные на этих местах лесные насаждения хорошо прижились и в настоящее время могут играть немаловажную роль в регуляции стока воды на горных склонах образовавшихся с атмосферных осадков. По системе лесонасаждений заложенных на горе Полонины Ровная, следует также расширить лесные насаждения в истоках реки Тиса за счет ели, пихты, кедра, можжевельников, ольхи серой и зеленой, рябины серой; а ниже в широких долинах этой реки насаждениями тополей, ольхи клейкой, ясени и ив. Последние, кроме водорегулятивных мероприятий могут послужить хорошим материалом для бумажной промышленности.

В условиях верховья реки Тиса образовалась своеобразная флора и фауна в Карпатах. Отдельные элементы флоры и фауны носят эндемичный или реликтный характер и заслуживают большое внимание со стороны их охраны. Из растений следует нодчеркнуть такие виды, как телекию прекрасную *(Teleskia speciosa* BAUMG.), колокольчик карпатский *(Campanula carpatica* JACQ.*)*, кадило карпатский *(Mellitis carpatica* W. et K.), окопник сердцевиднолистный *(Symphytum cordatum* W. et K.*)*, княжник лесной *(Atragene silvatica* FODOR*)*, аконит метельчатый *(Aconitum paniculatum* LAM.*)*, колокольчик пихтовый *(Campanula abientina* GRISEB. et SCHENK.*)*, василек карпатский *(Centaurea carpatica* JACQ.*)*, подснежник карпатский *(Galanthus carpaticus* FODOR*)*, шафран чаподия *(Crocus csapodiana* (HORVATH et JÁV.) FODOR*)* и другие произрастающие в лесах при истоках рек Черной и Белой Тисы. В поймах источников этой реки — на лугах и криволесьях встречаем такие редкостные элементы, как медуниэа филярского *(Pulmonaria Filarszkyana* JÁV.*)*, чемерица белая *(Veratrum album* L.*)*, лук победный *(Allium victoriale* L.*)*, первоцвет карпатский *(Primula carpatica* FUSS.*)*, горечавка желтая *(Gentiana lutea* L.*)*, безвременник осенний *(Colchicum autumnale* L.*)*, козелец розовый *(Scorzonera rosea* W. et K.*)*, на скалах, потом в высокогорном поясе первоцвет длиноцветковый *(Primula longiflora* ALL.), дороникум карпатский *(Doronicum carpaticum* GRISEB et SCHENK. NYM.*)*. Эдельвей альпийский *(Leontopodium alpinum* CASS*)* и. др.

С животного мира типичными представителями реки Тисы в верхнем ее течении являются из мягкотелых: *Limnaea stagnalis* MÜLL., *Planorbis planorbis* L., *Coretus corneus* L., *Viviparus contectus* MILL., *Galba truncatula* MÜLL., *Radix pereger* MÜLL., *Armiger crista* L., *Valvata piscinalis* MÜLL., *Radix auricularia* L., из членистоногих *Agabus solieri* AUBE., *Oreadytes rivalis* GYLL. из рыб: *Acipenser ruthenus* L., *Golitis montana* VLAD., *Bubo bubo* L. из земноводных: *Triturus montandoni* BOUL., *Bombina variegata* L.,

из пресмыкающих: *Vipera berus* L., *Lacerta vivipara* JACQ., из птиц: *Dryocopus martius* L., *Falco peregrinus* TUNT., *Ciconia nigra* L., из жлеопитающих: *Sorex alpinua* SCHINZ., *Neomys anomalus* CABR., *Felis catus* L., *Lynx lynx* L., *Ursus arctos* L.

Тиса-река нескольких стран. На любом месте реки проведенные полезные хозяйственные мероприятия значительно повлияют на другие территории. Поэтому работы по регулированию и изучению этой реки Тиса имеют международное значение.

Ужгород, госуниверситет,
18. 05. 1981.

A Tisza felső folyásáról

FODOR S. S., KOMENDÁR V. I., SCSERBÁNY M. I. és DUNINSZKI T. T.

Állami Egyetem Uzsgorod, Szovjetunió

Kivonat

A Szovjet-Kárpátok délnyugati lejtőinek termelési szintje a Tisza és mellékfolyóinak medencéjében összpontosul. Az ember azzal, hogy beavatkozott a természet ősi rendjébe kialakult egyensúlyát megbontotta. A zárt erdőségek a népvándorlás korában a Kárpátok gerincéről kipusztultak. Így a légköri csapadék visszatartását s az erózió meggátolását nem szolgálhatták. Hatására a terület élővilága mind nagyobb mértékben károsodott.

A ritkábban előforduló növényfajok közül még megtalálhatók: *Telekia speciosa, Campanula carpatica, Melittis carpatica, Symphytum cordatum, Astragena silvatica, Campanula vajdae, Syringa josikaea, Aconitum paniculatum, Campanula abietina, Centaurea carpatica*, stb

Állatfajai közül: *Limnaea stagnalis, Coretus corneus, Raxis pereger, Agabus solieri Oreadites rivalis, Triturus montandonis, Vipera berus, Dryocopus martinus, Sorex alpinus* stb

Sa gornjeg toka reke Tise

FODOR S. S., KOMENDÁR V. I., SCSERBÁNY M. I. i DUNINSZKI T. T.

Državni Univerzitet, Užgorod, SSR

Abstrakt

Produkcioni nivo jugozapadnih sovjetskih Karpata usmeren je na područje korita reke Tise i njenih pritoka. Usled antropogenog uticaja došlo je do narušavanja prirodne ravnoteže područja. Povezani sklop šumskih zajednica na bilu Karpata razbijen je još u doba seoba naroda. S toga nisu mogle obezbediti zadržavanje padavina i sprežiti erozione procese. U takvim uslovima došli je do sve jačeg osiromašenja živog sveta podrčja.

Od proredjenih biljnih vrsta još su prisutne: *Telekia speciosa, Campanula carpatica, Mellitis carpatica, Symphytum cordatum, Astragena silvatica, Campanula vajdae, Syringa josikaea, Aconitum paniculatum, Campanula abietina, Centaurea carpatica* i dr.

Kao retke životinjske vrste javljaju se: *Limnaea stagnalis, Coretus corneus Raxis pereger, Agabus solieri, Oreadites rivalis, Triturus montandonis, Vipera berus, Dryocopus martinus, Sorex alpinus* i dr.

On the Upper Flow of the River Tisza

FODOR S. S., KOMENDÁR, V. I. , SCSERBÁRY, M. I., DUNINSZKI, T. T.

State University, Uzsgorod, USSR

Extract

The forestry production of the South-West slopes of Soviet-Carpats is concentrated in the basins of Tisza and its tributaries. Human interference destroyed the ancient balance of nature in this area. Closed forests extincted from the Carpats' ridge during the Hungarian conquest (Xth century). That is why they couldn't contribute to the retainment of atmospherical humidity and to the preventation of erosion. These resulted in the growing damage of the area's flora and fauna.

Still there are the next rare plant-species to be found: *Telekia speciosa, Campanula carpatica, Melittis carpatica, Symphytum cordatum, Astragena silvatica, Campanula vajdae, Syringa josikaea, Aconitum paniculatum, Campanula abietia, Centaurea carpatica* etc.

The area's rare animal species are: *Limnaea stagnalis, Coretus corneus, Raxis pereger, Agabus solieri, Oreadites rivalis, Triturus mondandonis, Vipera berus, Dryocopus martinus, Sorex alpinus* etc.

Tiscia (Szeged) Vol. XVIII, pp. 59—63 (1983)

PHYSIKALISCH-CHEMISCHE EIGENSCHAFTEN UND DIE OLIGOCHAETENFAUNA DER THEISS

NADA DUKIĆ und MILA STANOJEVIĆ

Institut für Biologie der Naturwissenschaftliche-Mathematischen Fakultät, Novi Sad
Institut für Gesundheitsschutz, Novi Sad
(Eingegangen 18 November, 1981)

Auszug

Im Zeitraum von 1977—1981. wurde die Wasserqualität des Theissflusses in mehreren Längsprofilen erforscht. Es werden die Ergebnisse der Untersuchung der physikalischschemischen Eigenschaften und der Zusammensetzung der Oligochaetenfauna aufgezeigt.

Einleitung

Im Rahmen der systematischen Untersuchung der Wasserqualität des Theissflusses im Zeitraum von 1977—1981. wurden die physikalisch-chemischen Merkmale des Wassers und die Zusammensetzung der Oligochaetenfaune verfolgt.

Die Untersuchungen umfassen die organoleptischen und allgemeinen sanitären Eigenschaften, die toxikologischen Parameter, sowie eine Analyse der Zusammensetzung der Oligochaetenfauna.

Arbeitsmethodik

Die Proben für die chemischen Analysien wurden einmal im Monat in den Jahren 1977—1981., in mehreren Längprofilen des Theissflusses gesammelt. Der gelöste Sauerstoff und der BSB_5 wurden einzeln an allen Stellen ermittelt, und das Ergebnis als der Mittelwert für das Profil ausgedrückt.

Die Laboranalysen der Proben wurden im Institut für Gesundheitsschutz in Novi Sad durchgeführt. Ermittelt wurden die Indikatoren der Sauerstoffverhältnisse der grundlegenden chemischen Zusammensetzung, sowie die spezifischen Materien. Zur Analyse der physikalisch-chemischen Kennziffern wurden die KGST-Methoden (1) angewandt. Der gelöste Sauerstoff wurde nach der Winklers Methode bestimmt, der Sauerstoffverbrauch mittels $KMnO_4$ nach Kubel-Thiemann, das Ammonium-Ion durch unmittelbare Nesslerisierung. Die Nitrate wurden kolorimetrisch mittels Brucin, die Nitrite mittels Alfanaphtilamin und Sulfanilsäure, die Alkalität acidimetrisch, die Härte komplexometrisch mittels EDTA, die Chloride nach Mohr, die suspendierten Materien und gelösten Salze gravimetrisch, die Phenole mittels 4-Aminopyrin, die aktiven Detergentien durch Extraktion nach der Methylenblau-Methode, der Gesammtstickstoff nach Kjeldahl, Kalium und Natrium flammenphotometrisch, die Fettstoffe durch Extraktion nach Soxleth bestimmt.

Zu gleicher Zeit wurde auch das Material für Analyse der Oligochaetenfauna mittels eines Baggers vom Typ Ekman—Birge, mit einer Angriffsfläche von 225 cm^2 gesammelt. Das Material wurde für die taxonomische Bearbeitung nach den standardisierten Methoden vorbereitet. Die Determinierung der Oligochaeten erfolgte auf lebenden Exemplaren.

Ergebnisse und Diskusion

Die Analysenwerte der physikalisch-chemischen Eigenschaften des Wassers werden als Extremwerte (Minimal- und Maximalwerte) in Tabelle 1 aufgezeigt, sowie auch als Mittelwerte im Hystogramm 1. für den Zeitraum 1977—1981.

Der Theissfluss wurde bei Durchflussmengen von 260—2720 m^3/sec erforscht. Die Wassertemperatur bewegte sich in den Grenzen von 0—25 C. Die Veränderungen der Wassertemperatur wirkten sich auf die Variierung der Anzahl der Oligochaeten aus, was auch von A. Noskova bestätigt wird.

Der Gehalt an Schwebestoffen bewegte sich zwischen 6 und 518 mg/l, im Durchschnitt zwischen 77 und 174 mg/l; je nach den meteorologischen Verhältnissen. Hohe Werte wurden bei einer Zunahme des Wasserstendenz im Frühlingszeitraum festgestellt, oder aber beim Auftreten einer Flutwelle im Einzugsgebiet des Flusses. Dies wirkte sich auf die erhöhte Trübung des Wassers aus, so dass die Durchsichtigkeit zwischen 8—35 mm variierte. In diesem Zeitraum konnte man auch höhere Mengen von Schwimsttoffen verzeichnen, und zeitweise beobachtete man einen Fettfilm auf einzelnen Oberflächen des Wasserspiegels.

Der Gesammtgehalt an gelösten Salzen war zufriedenstellend, und betrug 314 bis 360 mg/l; auch wurde eine jährliche Zunahme von 3,7% beobachtet.

Das Wasser der Theiss kennzeichnen die Ca-Mg-Hydrokarbonate. Von den Anionen herschten Hydrokarbonate vor (97—240 mg/l), weiters Sulfate (32—116 mg/l), Chloride (24—148 mg/l) und Nitrate (1,5—14 mg/l). Die Kationen waren am häufigsten durch Kalcium, Magnesium, Natrium und Kalium vertreten.

Die Werte der Gesammthärte bewegten sich zwischen 4,6 und 11,2° dH. Die Analysen der pH-Werte weissen auf ein schwach alkalisches Mitte (7,3—8,2), was zufriedenstellende Bedingungen für das Gedeihen der Oligohaeten ergibt.

Die Werte des gesammten und des gelösten Eisens im Wasser varierten bedeutenden (von 0,04 bis zu 2,1 mg/l), wohl als Folge der Erosion der Ufer bei erhöhten Wassersstand.

Der Mittelwert des Jahres für das Ammoniumion bewegte sich von 0,32 bis zu 0,70 mg/l, Extremwerte auch bis zu 3,1 mg/l verzeichnete man im Jahre 1980. Hohe Werte wurden im Winterzeitraum nachgewissen.

Die Jahres-Mittelwerte des im Wasser gelösten Sauerstoffs, von BSB_5 und $KMnO_4$-Verbrauch sind im grossen und ganzen zufriedenstellend. Es konnten jedoch bedeutende Variierungen im Jahresverlauf verzeichnet werden — so bewegte sich der gelöste Sauerstoff von 4,8—12,8 mg/l, die Sauerstoffsättigung von 35—98%, der BSB_5 von 1,7—7,7 mg/l, und der $KMnO_4$-Verbrauch von 3,1—13,3 mg/l. Durch Vergleich der Werte für den Zeitraum 1976—1978 konnte festgestellt werden, dass der gelöste Sauerstoff und die Sauerstoffsättigung stagnieren, während der BSB_5 und der $KMnO_4$-Verbrauch eine zunehmende Tendenz aufweisen. Dies weist auf eine zunehmende Belastung des Theisswassers durch organische Stoffe hin.

Die nachgewissenen Phenole und Detergentien hatten ebenfalls eine jährliche Zunahme von 7,7%.

Die Vorkommen von Ölen und Fetten auf der Oberfläche des Wasserspiegels wurden als ätherischer Extrakt nachgewissen und betrugen 12—33 mg/l, mit einer durchschnittlichen jährlichen Zunahme von 8%. Der Theissfluss zeigt bedeutende Oszilationen in seiner physikalisch-chemischen Qualität. Re bringt es jedoch in der Regel, zuwege, die vom Oberlauf herrührende Belastung zu bewältigen, und kam somit in die Wasserläufe mit geringerer Belastung eingereicht werden. Der

Physikalisch-chemische Eigenschaften des Theisswassers im unteren Flusslauf—Minimal—Maximal und Mittelwerte im Zeitraum 1977—1981.

Kennzeichen	Untersuchungsjahr 1977		1978		1979		1980		1981	
	min.	max.	min.	max.	min.	max.	min.	max.	min.	max.
1. Lufttemperatur °C	−6	30	−4	20	−10	* 28,6	−5	29	−5	34
2. Wassertemperatur °C	1	25	1.1	24	0	24,9	0	22	0	24
3. Farbe des Wassers °Pt-sk.	8	38	7	37	10	40	8	38	10	40
4. Durchsichtigkeit des W.mm	47	153	30	290	8	320	35	350	18	140
5. pH-Wert	7,7	8,5	7,5	8,4	7,3	8,0	7,3	8,1	7,5	8,2
6. Gelöster O_2 mg/L	6,0	11,5	4,8	11,5	5,6	11,4	4,3	11,5	4,8	12,8
7. Sauerstoffsätigung %	68	96	58	85	57	88	35	85	85	98
8. CSB ($KMnO_4$) mg/L	4,3	6,5	4,2	14,7	3,1	7,7	4,2	11,2	3,3	13,3
9. CSB ($K_2Cr_2O_7$) O_2 mg/L	16	32	12	37	13	47	14	44	22	49
10. BSB_5 O_2/L	2,2	6,1	2,4	7,5	1,4	7,5	2,7	7,7	1,7	7,0
11. Amonium NH_4^+ mg/L	0,16	1,25	0	2,2	0,1	1,8	0,1	3,1	0	0,85
12. Nitrite NO_2^- mg/L	0,007	0,15	0,07	0,47	0,09	0,40	0,04	0,6	0	0,32
13. Nitrate NO_3^-mg/L	3,5	15	4,6	13	4,6	14	2,5	22	0	11
14. Alkalität mVal	2,0	3,4	2,2	3,5	1,6	3,6	2,1	3,7	2,2	4
15. Gesamthärte °dH	7,3	13	8,8	14	7,3	15	6,4	15,4	7,3	14,3
16. Karbonathärte °dH	5,6	9,5	8,2	9,8	4,6	10,1	5,9	10,3	6,1	11,2
17. Chloride Cl^-mg/L	24	78	28	148	23	79	18	75	18	78
18. Sulfate SO_4^{--}mg/L	32	70	39	94	34	82	30	105	38	116
19. Gesamtabdampfrückstand bei 105 °C mg/L	302	660	310	877	294	915	315	607	214	982
20. Schwebestoffe mg/l	6	307	23	518	8	420	6	270	5	488
21. Gelöste Fette mg/L	232	406	192	472	190	479	198	392	201	629
22. Phenole mg/L	0	0,015	0	0,01	0	0,017	0	0,040	0	0,012
23. A. A. Detergenten mg/L	0,020	0,15	0,08	0,096	0,003	0,15	0	0,31	0,03	0,22
24. Gelöste Eisen Fe^{3+} mg/L	0,11	0,55	0,04	0,56	0,8	0,35	0,25	1,8	0,2	2,1
25. Phosphate P_2O_5 mg/L	0,2	1	0	1	0	2	0	3	0	2
26. Gesamtstickstoff N mg/L	1,1	5,3	1,4	12,2	1,2	8,7	1,1	4,2	1,7	3,1
27. Kalium K^+ mg/L	3,0	5,6	3,5	6,2	3,9	11,1	2	9,4	5	10,8
28. Natrium Na mg/L	12	46,3	17,5	43,5	18,3	61,2	9,5	48,8	18,5	48,1
29. Ole und Fette mg/L	9,8	46,7	5	27	5	38,2	3	10,6	16	169
Durchfluss Qm/sec.	630	2720	646	1950	740	2620	260	2110		

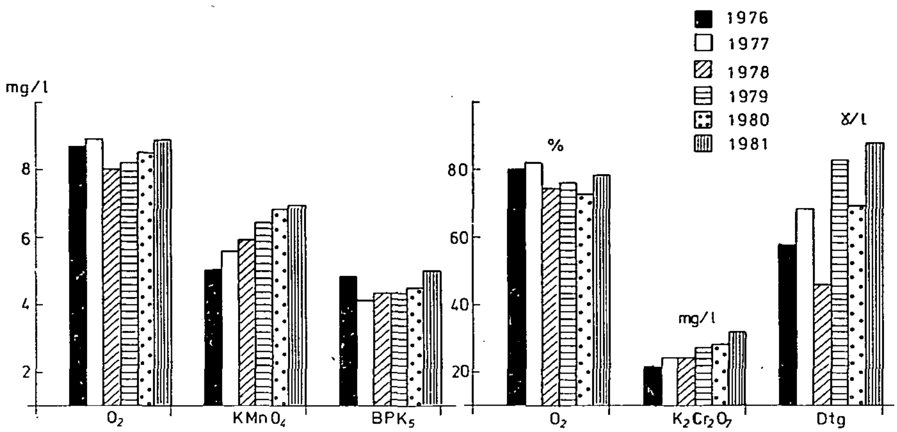


Abb. 1. Physikalisch-chemische Eigenschaften der Theiss (1976—1981) Mittelwerte.

physikalisch-chemischen Eigenschaften des Milieus wirken sich wesentlich auf die Anwesenheit und Häufigkeit der einzelnen Oligochaetenarten aus. Im Erforschungszeitraum von 1979—1981 bewegte sich der Anzahl der Oligochaeten von 188,7 Individuen je m^2 bis zu 222 Ind/m^2.

Die qualitative Zusammenstellung der Oligochaeten im ufernähen Bereich des Theissffusses zeigte das Vorkommen von 11 Oligochaetenarten aus 8 Gattungen und 2 Familien — Naididae und Tubificidae:

Nais communis PIGUET (1906)
Dero obtusa UDEKEM (1855)
Potamothrix hammoniensis MICHAELSEN (1901)
Tubifex tubifex MÜLLER (1774)
Ilyodrilus perrieri EISEN (1879)
Limnodrilus hoffmeisteri CLAPAREDE (1862)
L. claparedeanus RATZEL (1868)
L. udekemianus CLAPAREDE (1862)
L. helveticus PIGUET (1913)
Branchyura sowerbyi BEDDARD (1892)
Peloscolex velutinus GRUBE, UDE (1929)

Die Anzahl der Oligochatenarten nahm mit den Jahren nicht ab, was für eine ziemliche Stabilität dieses Wasserlaufs hinweist. Dies bestätigen die Saprobität, Erforschungen die sich stets im Rahmen des -mesosaproben Stufen bewegte (PUJIN, STANOJERIĆ 1979).

Schlussforgerungen

Gemäss den Erforschungen im Zeitraum von1977—1981, weist der Theissfluss bedeutende Oszillationen der physikalisch-chemischen qualität des Wassers auf. Der Fluss bringt es zuwege die vom Oberlauf herrührende Belastung zu bewältigen, und kann somit zu den Wasserläufen mit einem niedrigeren Belastungsgrad zugezählt werden.

Es wurde eine zifriedenstellende Sauerstoffbilanz festgestellt. Der $KMnO_4$ Verbrauch und der BSB_5 hatten eine Tendenz einer schwächeren Zunahme, was auf eine stufenweise zunehmende Belastung des Theisswassers durch organisches Stoffe hinweist.

Während einer Hochwasser wird das Theisswasser durch Stoffe mineralischer und organischer Herkunft belastet.

Die Bedingungen der physikalisch-chemische Zusammensetzung des Wassers beeinflussten die zahlenmässige Dynamik und das Vorkommen der einzelnen Oligochaetenarten im ufernahen Bereich des Theissflusses.

Die Individuenanzahl veriierte von 188,7 Ind/m^2 bis zu 222 Ind/m^2. Die qualitative Analyse der Oligochaeten zeigte das Vorkommen von 11 Oligochaetenarten aus 8 Gattungen und 2 Familien der Naididae und Tubificidae.

Die Anzahl der festgestellten Oligochaetenarten zeigte keine Variierungen mit den Jahren, was für eine ziemliche Stabilität dieses Wasserlaufs spricht.

Literatur

BRINKHURST, R. O., JAMIENSON, G. M. (1971): Aquatic Oligochaeta of the World, Oliver-Boyd, pp. 1—860, Edinburg.

NOSKOVA, A. A. (1972): K faune oligohet centralnogo plesa Kuibiševskogo vodohranilošća. — Trudi vsesojuznoe gidrobiologičeskoe obšćestvo, 17, 156—161.

PUJIN, V., STANOJEVIĆ, M. (1979): Hydrobiologische Untersuchungen des unteren Theisslaufs. — Tiscia (Szeged), *14*, 131—138.

A Tisza fizikai-kémiai tényezői és Oligochaeta faunája

DJUKIĆ NADA és STANOJEVIĆ MILA

TTK Biológiai Intézet, Novi Sad,
Orvostudományi Kar, Egészségügyi Intézet, Novi Sad

Kivonat

A szerzők 1977—1981 közötti időszakban hossz-szelvényvizsgálattal a Tisza vízminőségét tanulmányozták. A dolgozatban a Tisza viz fizikai-kémiai tulajdonságait, valamint az Oligochaeta fauna összetételét ismertetik.

ФИЗИЧЕСКО-ХИМИЧЕСКИЕ ХАРАКТЕРИСТИКИ И ФАУНА О р. ТИССА

Нада Джукич и Мила Станоевич

Биологическии институт Естественно-математического факультета, г. Нови Сад
Институт здравоохранения Медицинского факультета, Нови Сад

Резюме

В периоде с 1977 по 1981 г.г. были проведены испитания качества воды р. Тисса на нескольких разрезах. Дан обзор результатов испытании физическо-химических характеристик воды и состав фауны олигохеты.

Tiscia (Szeged) Vol. XVIII, pp. 64—68 (1983)

SOME FLORA FEATURES OF THE SOUTHERN PORTION OF THE TISZA RIVER REGION

MELANIJA OBRADOVIĆ, P. BOŽA and VERA BUDAK

Faculty of the Natural and Mathematical Sciences, Institute of Biology
Novi Sad, Yugoslavia
(Received Februar 10, 1980)

Abstract

The paper presents a taxonomic and phytogeographic survey of four rare species and two new infraspecies taxonoms in the flora of the southern portion of the Tisza River region.

Viola pumila CHAIX *in* WILLD. is a Euro-Asian plant rare in the studied region.

Chenopodium capitatum (L.) ASCH. is probably of North American origin, an adventive ephemerophyte recorded in the southern portion of the Tisza River region only in the vicinity of Kanjiža.

Astragalus asper WULF. *in* JACQ. is a Pontic-Pannonian species which, in the region studied, grows on the Subotica sand-lands and its taxonom *f. Karpatii* Soó near Kelebija.

Alkanna tinctoria (L.) TAUSCH. is a sub-Mediterranean plant recorded in the southern portion of the Tisza River region near Ridjica, Subotica, Madaraša and on the Subotica sand-lands, while its taxonom var. *parviflora* BORB. f. *Lehmanni* (TINEO *in* GUSS.) PODP. is found on the Titel Plato.

Introduction

Recent studies of the flora of the southern portion of the Tisza River region indicate that this region is interesting for a number of rare plants. In this paper a more detailed description will be given of the Euro — Asian species *Viola pumila* CHAIX. in WILLD.; of an adventive ephemerophyte, probably of North American origin, *Chenopodium capitatum* (L.) ASCH.; of two plants with a more narrow area of distribution *Astragalus asper* WULF. in JACQ. which belongs to the Pontic-Pannonian flora element and *Alkanna tinctoria* (L.) TAUSCH. from the group of sub-Mediterranean species. Two of their infraspecies taxonoms are also recorded since they are new to the southern portion of the Tisza River region, to Vojvodina i Srbija.

Taxonomic and Phytogeographical Data

F. Violaceae

Viola pumila CHAIX in WILLD. belongs belongs to the Euro-asian flora element. It is rare in the Balkans and is not found in the southern region of the peninsula. In the north it has been found to grow all the way up to the Baltic (Soó 1968). Among the flora of the Balkan Peninsula it is cited for Srbija and Bulgaria (HAYEK 1927).

the flora of Srbija records it only for the eastern region—near Brestovačka banja (JOSIFOVIĆ 1972). In the Bačka region, it has been found to grow near Futog (PRODAN 1916), while for the Tisza River region it was cited near Stari Bečej, from where it has since disappeared (KOVÁCS 1929). In recent years we have discovered it in the southern portion of the Tisza River region near Djala, on marshy meadows.

F. Chenopodiaceae

Chenopodium capitatum (L.) ASCH. belongs to the southern Euro-Asian group of plants, but also grows both in Siberia and in North America, from where it probably originated. It is rarely cultivated as a decorative or vegetable species. It is adventive and ephemerophyte in character (SOÓ 1970). It was introduced to Europe (TUTIN *et al.* 1964), but also appears subspontaneously (HAYEK 1927, JOSIFOVIĆ 1972). For the Bačka region it is cited as cultivated (PRODAN 1916), and for Srbija as cultivated and appearing subspontaneously, here and there (JOSIFOVIĆ 1972). The first determined site of this species in Vojvodina, on which it grows subspontaneously, is in the southern portion of the Tisza River region, near Kanjiža, on rural locations, beside railroad tracks.

F. Fabaceae

Astragalus asper WULF. in JACQ. is a species which belongs to the Pontic- Pannonian flora element and is widespread all the way up to Austria (SOÓ 1966). In Europe it grows in the eastern and central regions, and in the south, up to North Bulgaria (TUTIN *et al.* 1968). In the south-eastern portion of Central Europe it is present in the Pannonian and Erdian depressions (JÁVORKA 1925). According to the recorded flora of Srbija it grows only in Vojvodina on the meadows and woodlands of the Fruška gora hills and on the Deliblato sand-lands (JOSIFOVIĆ 1972). In the Bačka region, it has been recorded near Kovilj (ZORKÓCZY 1896) and on the Subotica sand-lands (ŠTURC 1973). In the region of Kelebija, the form *Karpatii* has been discoverned as new to the flora of Vojvodina and Srbija (JOSIFOVIĆ 1972, 1977).

F. Boraginaceae

Alkanna tinctoria (L.) TAUSCH. belongs to the group of sub-Mediterranean plants (SOÓ 1968). It is widespread in the sandy regions of Southern Europe, and in the north all the way up to South-Eastern Czechoslovakia (TUTIN *et al.* 1972). In the Pannonian region it has been found to grow with certainty only betweem the Danube and Tisza rivers (JÁVORKA 1925). In Srbija it is cited as growing only near Stara Pazova (JOSIFOVIĆ 1974, 1977). In the Bačka region it has been recorded near Ridjica, Subotica and Madaraša (PRODÁN 1916) and on the Subotica sand-lands (ŠTURC 1973). In recent years, we have found a type form also on the Deliblato sand-lands, and an infraspecies taxonom var. *parviflora* BORB. f. LEHMANNI (TINEO in GUSS) PODP. on the Titel Hills. This data is new to the flora of the southern portion of the Tisza River region, to Vojvodina and Srbija.

Discussion

On the basis of chorographic data on the distribution of the four above-described species, it can be perceived that these are rare and significant plants to the flora of the southern portion of the Tisza River region. *Viola pumila* CHAIX in WILLD. is of wider distribution and belongs to the Euro-Asian flora element (SOÓ 1968). In the flora of Srbija it has been cited only for Brestovačka banja (JOSIFOVIĆ 1972, 1977). Formerly in Vojvodina it was recorded on two sites, both in the Bačka region, near Futog (PRODÁN 1896) and near Stari Bečej (KOVÁCS 1929), from where it has since withdrawn. We have found it on the marshy meadows near Djala in the northern portion of the Banat region, a fact which represents new data for the region. *Chenopodium capitatum* (L.) ASCH. is cited as a cultivated species for Srbija, but one which also grows subspontaneously, here and there (JOSIFOVIĆ 1972). It belongs to the adventive species and is of ephemerophyte character, ad probably originated from North America (SOÓ 1970). Its discovery on rural locations near railroad tracks in the vicinity of Kanjiža is the first determined location of this plant, as a subspontaneous one, in the southern portion of the Tisza River region and in Vojvodina. From the phytogeographical standpoint, two autochthonous species for the flora of the southern portion of the Tisza River region are of special interest. The first one is *Astragalus asper* WULF. in JACQ. which belongs to the Pontic-Pannonian flora element. It is present in the south-eastern region of Central Europe, in the Pannonian and Erdian depressions (JÁVORKA 1925), and in the south, it extends to North Bulgaria (TUTIN *et al.* 1968). For the flora of Srbija, it is cited only on two locations, both of them in Vojvodina, on the Fruška gora Hills and the Deliblato sand-lands (JOSIFOVIĆ 1972). In the Bačka region, it has been recorded near Kovilj (ZORKÓCZY 1896) and on the Subotica sand-lands (ŠTURC 1973), which represents its only location in the southern portion of the Tisza River region. Near Kelebija, a new infraspecies taxonom f. *Karpatii.* has been determined with in this species, a fact which has not been known to the flora of Srbija. The second one is *Alkanna tinctoria* (L.) TAUSCH. which is a sub-Mediterranean species. In the north it spreads to Hungary, Rumania (SOÓ 1968) and to Czechoslovakia (TUTIN *et al.*). For the flora of Srbija, it has been recorded only near Stara Pazova, in the Srem region (JOSIFOVIĆ 1974). In past literature it has also been cited for the southern portion of the Tisza River region, near Ridjica, Subotica, Madaraša (PRODÁN 1916) and on the Subotica sand-lands (ŠTURC 1973). We have also found it on the same locations and on the Deliblato sands, and on the Titel Plato, we have found a new taxonom for the flora of Vojvodina var. *parviflora* BORB. f. *Lehmanni* (TINEO in GUSS.) PODP. The presence of these two rare species among the flora of the southern portion of the Tisza River region, reveals the influence of both Pontic-Pannonian and southern sub-Mediterranean flora on the region studied. These plants had come to inhabit the flora of the Pannonian Plain and the southern portion of the Tisza River region, during warmer geological ages.

Conclusion

During a study of the flora of the southern portion of the Tisza River region four rare plant species and two new infraspecies taxonoms have been recorded.

Viola pumila CHAIX in WILLD. is a plant of more extensive distribution, a Euro-Asian species, but rare in the region studied. Today it is present in the vicinity of Djala, in the Tisza River valley, on marshy meadows.

Chepodium capitatum (L.) ASCH. is an adventive ephemerophyte and probably of North American origin. In natural vegetation it grows in the vicinity of Kanjiža, near railroad tracks, as a subspontaneous species. This record is the only location in the southern portion of the Tisza River region.

Astragalus asper WULF. in JACQ. is a Pontic-Pannonian plant. It is a rare plant inhabitant of Vojvodina. In the southern portion of the Tisza region it has been recorded only on the Subotica sand-lands. The discovery of the *Karpatii* form near Kelebija represents new data for the flora of Vojvodina and the southern portion of the Tisza River region.

Alkanna tinctoria (L.) TAUSCH. is a sub-Mediterranean plant. It is present in the southern portion of the Tisza River region in the vicinity of Ridjica, Subotica, Madaraša and on the Subotica sand-lands. New data for the flora of Vojvodina and the southern portion of the Tisza River region is the discovery of an infraspecies taxonom var. *parviflora* BORB. f. LEHMANNI (TINEO in GUSS.) PODP. on the Titel Plato.

From the phytogeographical standpoint, the plants *Astragalus asper* WULF. in JACQ., which belongs to the Pontic-Pannonian flora element, and *Alkanna tinctoria* (L.) TAUSCH., which is a sub-Mediterranean species, are important as remains of the flora which differentiated itself in the Pannonian depression in warmer geological ages.

References

HAYEK, A. (1927): Prodromus Florae peninsulae Balcanicae, Band I. Verlag des Repertoriums, Dahlem bei Berlin.

HEGI, G. (1965): Illustrierte Flora von Mitteleuropa, Band V/I, München.

JÁVORKA, S. (1925): Magyar flóra, Studium, Budapest.

JOSIFOVIĆ, M. (1972, 1974, 1977): Flora SR Srbije, III, IV, VI, VII, SANU, Beograd.

KOVÁCS, F. (1929): Óbecse határának virágos növényei, Szeged.

PRODÁN, GY. (1916): Bács—Bodrog vármegye flórája, Pallas, Budapest.

SOÓ, R. (1966, 1968, 1970): A magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve, II, III, IV, Akadémiai kiadó, Budapest.

STURC, B. (1973): Mit kell megtartanunk és megvédenünk Bácska északkeleti részének növénytakarójában, Szabadka.

TUTIN, T. et al. (1964, 1968, 1972): Flora Europea, Volume 1, 2, 3, At the University press, Cambridge.

ZORKÓCZY, L. (1896): Újvidék és környékének flórája, Újvidék.

A déli Tisza szakasz néhány florisztikai jellemzője

MELANIJA OBRADOVIĆ, BÓŽSA P. és VERA BUDAK

Tudományegyetemi Biológiai Tanszék, Novi Sad, Jugoszlávia

Kivonat

Ebben a dolgozatban elemeztük a déli Tisza-szakasz flórájának négy faját és két új fajalatti taxont. — *Viola pumila* CHAIX in WILLD. a Tisza déli szakaszának ritka növénye. Óbecse környékéről eltűnt. Újabban az Észak-Bánátban Gyala környékén találtuk nedves réteken. — *Chenopodium capitatum* (L.) ASCH. A kutatott területen csak ruderális társulásokban volt megtalálható Kanizsa környékén, mint subspontán növény. — *Astragalus asper* WULF. in JACQ. A Tisza mentén Szabadka homokvidékén fordul elő. A f. *Kárpátii* SOÓ, mint a vajdasági flóra új taxonja Kelebiánál lelhető fel. — *Alkanna tinctoria* (L.) TAUSCH elterjedése Észak-Bácskában: Regőce, Szabadka, valamint a szabadkai homokvidék. A var. *parviflora* BORB. f. *lehmanni* (TINEO in GUSS.) PODP. a titeli fennsíkon való előfordulása új adat a Vajdaság flórájára.

Neke florističke odlike južnog Potisja

MELANIJA OBRADOVIĆ, PAL BOŽA i VERA BUDAK

U radu su prikazane četiri retke biljne vrste južnog Potisja i dva nova infraspecijska taksona

Izvod

Viola pumila CHAIX in WILLD. jeretka vrsta u Potisju iz okoline Starog Bečeja se povukla a. u novije vreme je nadjena na vlažnim livadama kod Djale u severoistočnom Banatu.

Chenopodium capitatum (L.) ASCH. je u ispitivanom području zabeležen kao subspontana biljka samo u ruderalnoj vegetaciji kod Kanjiže.

Astragalus asper WULF. in JACQ. raste u Potisju na Subotičkom pesku a njegova forma *Karpatii* Soó kod Kelebije kao nov takson u flori Vojvodine.

Alkanna tinctoria (L.) TAUSCH. rasprostranjena je u severnoj Bačkoj kod Ridjice Subotice i na Subotičkom pesku a takson var. *parviflora Borb. f. Lehmanni* (TINEO in GUSS.) PODP. na Titelskoj visoravni je nov za floru Vojvodine.

НЕКОТОРЫЕ ФЛОРИСТИЧЕСКИЕ ОСОБЕННОСТИ ЮЖНОГО ПОТИСЬЯ

М. Обрадович, П. Божа, В. Будак

Природно-математический факультет, Биологического института
Новый Сад, Югославия

Резюме

В статье излагается таксономический и фитогеографический обзор четырех очень редких видов растений из флоры южного Потисья: *Viola pumila* CHAIX — евразиатский вид, редко встречаемый в районе исследования. *Chenopodium capitatum* (L.) ASCH адвентивный эфемероид происхождением из северной Америки. У нас встречается исключительно только в Южном Потисье (возле Канижи).

Astragalus asper JACQ. — понтойско-паннонский вид, в районе исследования растет на Суботинском песке, причем f. KARPATII в окресности Келебии. *Alkanna tinctoria* (L.) TAUSCH. субмедитеральный вид обнаружен нами в Южном Потисье, в районе Риджице, Суботице, Мадараша, а также на Суботическом песке, еъ var. *parviflora* BORB. f. *Lehmanni* (TINEO in GUSS.) PODP. на Тительском плоскогорьи.

Tisc.a (Szeged) Vol. XVIII, pp. 69—75 (1983)

TAXONOMIC AND ECOLOGICAL COMMENTS RELATING MACRO- AND MICRO-ELEMENT CONCENTRATIONS IN PLANT SPECIES OF INUNDATION AREA

GY. TÖLGYESI and A. KOZMA

University of Veterinary Sciences, Budapest
(Received June 20, 1981)

Summary

13 elements in 45 samples of 41 plant species grown on the middle reach of Tisza at Abádszalók were analysed. It were observed some taxonomic correlations and some accumulating species were recognized. It was established that the vegetation contains no toxic concentrations of the investigated elements although the zinc contents is a multiple of the average of the Hungarian flora. Consequently the hay from the inundation areas is very suitable to complete field grown fodder plants with low zinc contents.

During the chemical analysis performed by authors and coworkers always succeded to obtain some general rules. Such evaluations were published about the vegetations along the rivers Zala (TÖLGYESI and KÁRPÁTI 1977), Danube (KOZMA and TÖLGYESI 1979), and Tisza (KOZMA and TÖLGYESI 1979). Here report will be given about an inundation area of the Tisza (at Abádszalók) the vegetation of which was already surveyed on the XIth Conference about Tisza-Research (KOZMA and TÖLGYESI 1980). 45 samples including 41 species were investigated with methods described in earlier publications. In the first line ion-selectivity of plants living in the same biotop will be described in connection with concrete examples. For the practice mineral contents of the hydrophilous and hygrophilous vegetation along this reach of the Tisza will be explained and compared to other meadows of inundation area in Hungary. These data can be utilized in plant cultivation, feeding and environment conservation.

Taxonomic correlations

Data of chemical composition in Table 1. relate in the case of herbaceous plants to the whole overground part while in the case of lignous plants to a 35 cm long leafy twig.

It can be established that family Gramineae is characterized by low Ca, Mg, Cu and B contents. Latter character can generally be observed on dry habitats as well (TÖLGYESI and KOZMA 1974). The same characters separate the so called acidic grasses (Cyperaceae, Juncaceae, Typhaceae) from the dicotyledons. Their high manganese contents separates them at all events. Average concentration of all the species is 88.3 mg per kg while *Carex vesicaria* contains 725 ppm magnanese. Great differences in manganese uptake between the species is characterized by a variance coefficient of 167 per cent. Manganese is very suitable for taxonomic separation; on the investigated area which was less than one hundred square metres its concentration varied between 13 and 725 ppm. If also hair-weeds and other aquatic plants had been investigated, the highest manganese contents would attain 40 000 ppm. While variance coefficient of the macro-elements potassium and magnesium is relatively low (28 per cent), that of sodium which on the basis of its general occurrence may be considered as a meso-element is high (78 per cent). It is interesting that some species with high manganese concentration contain high sodium concentration as well. This correlation is significant; according to data of Table 2. it can be characterized by a correlation coefficient of 0.59. For these species during evolution a good sodium and manganese supply was assured by salt accumulation and reductive environment in the wet soil.

Variance of sulfur concentration (average 3.55 g per kg) is 53 per cent. In general, species rich in sulfur are rich in calcium, phosphorous, boron, and copper as well which is shown by significant correlation coefficients. *Xanthium italicum* and *Sium latifolium* proved to be sulfur-accumulants in earlier investigations too, while *Rorippa austriaca* as a member of the family Cruciferae has a higher sulfur contents than the average value — as it was expected.

Between extreme values of iron and aluminium the differences are thirteenfold and variance is also high: 59 per cent and 71 per cent respectively. Taxonomix separation is not expressed, only lower iron contents of the monocotyledons might be mentioned.

Molibdenum contents in Fabaceae is 1.10 ppm in average, definitly higher than that of the whole collections: 0.64 ppm in average. The difference is more expressed when compared with the average value 0.35 observed in the 21 samples of dicotyledons (Fabaceae excepted).

Higher copper concentrations were consistently observed in the species of Compositae and Labiatae. It must be mentioned the high (20.6 ppm) copper contents of *Alisma plantago-aquatica,* a value rarely observed among monocotyledons. This is the consequence of the biochemical habitus and not a result of a contamination. The average copper contents (9.9 ± 4.1 ppm) corresponds to the average value observed in Hungary.

One of us earlier reported the prominent zinc accumulation in the Salicaceae: the same was observed here in *Populus* and *Salix*. Species of the genera *Lycopus* and *Lythrum* occurring on the inundation area were registered as new zinc accumulating plants. Revising earlier collections these species proved to be leading in this respect inside other associations. Uptake of zinc can be connected with the uptake of three other elements (Ca, Mg, Fe) only while copper kalcium, boron, and phosphorous uptake showed parallel changes with eight-eight other elements.

Ecological notes

Zinc contents observed on the inundation area of Abádszalók is significantly higher than the average value (36.9 ppm) of the 54 families of the Hungarian flora (Tölgyesi, in preparation): in the 45 samples in average 75.8 ppm zinc was found. Is this characteristic on the Middle-Tisza? To answer the question the Compositae species were examined. In the recent collection the Compositae show an average value of 83 ppm; earlier in the same family in Tokaj 73 ppm, in Tiszasüly 108 ppm,

Table 1. *Composition of plant species collected on the inundation area of Abádszalók on 28 June 1979*

	K	Ca	P	S	Mg	Na	Al	Fe	Mn	Zn	B	Cu	Mo
	g/kg						mg/kg						
Glyceria maxima	18.3	2.8	2.06	1.76	1.72	0.52	45	76	110	31.6	5.3	8.1	0.85
Lolium perenne	15.0	3.2	2.87	3.27	1.32	0.88	60	92	32	33.2	4.9	4.6	2.44
Poa palustris	16.3	2.0	1.92	2.29	1.16	0.40	45	63	20	64.0	4.2	5.4	0.45
Poa palustris	14.8	2.0	1.67	1.34	1.44	0.72	48	58	15	16.8	5.5	5.2	0.68
Puccinellia limosa	16.3	1.6	2.77	2.93	1.08	0.40	42	82	42	38.8	3.8	8.9	0.32
Typhoides arundinacea	14.0	2.8	1.33	2.07	1.20	0.36	35	63	29	44.0	5.1	4.2	0.39
Bolboschoenus maritimus	20.8	6.8	1.39	1.76	1.80	1.96	96	100	150	94.0	11.8	13.1	0.55
Carex vesicaria	19.3	3.4	1.65	2,00	1.48	0.48	163	185	725	56.0	8.0	8.6	0.34
Eleocharis palustris	18.3	5.2	1.30	3.05	0.64	0.52	42	68	74	98.0	10.0	5.7	0.47
Schoenoplectus palustris	14.8	5.4	1.40	4.15	1.56	2.92	68	83	600	18.8	10.0	3.5	0.36
Juncus articulatus	18.5	5.4	2.04	4.92	1.68	1.60	317	269	115	92.0	11.8	13.1	1.72
Typha angustifolia	22.7	14.2	1.73	2.02	2.00	2.92	24	35	390	22.0	14.4	5.4	1.29
Typha latifolia	18.8	11.4	2.32	1.87	1.88	0.88	34	54	160	27.6	26.6	6.1	1.11
Alisma plantago-aquatica	21.3	12.8	2.46	3.58	2.44	2.40	90	117	360	66.0	16.6	20.6	0.34
Amorpha fruticosa	12.5	11.0	2.14	2.12	2.00	0.44	63	176	63	38.0	36.7	14.7	1.36
Galega officinalis	18.8	9.8	2.53	3.17	2.16	0.56	76	130	31	60.4	24.1	10.7	1.57
Glycyrrhiza echinata	17.3	13.0	2.80	2.85	1.84	0.56	102	307	42	41.6	24.3	10.9	0.48
Lotus corniculatus	22.8	11.2	2.16	2.37	1.72	1.04	95	130	13	52.0	13.7	9.5	0.43
Melilotus officinalis	16.8	13.4	2.28	3.81	2.44	0.44	59	111	16	39.2	45.0	9.1	0.58
Trifolium campestre	21.5	10.8	2.96	3.49	1.86	0.44	103	149	17	77.2	18.4	9.8	0.49
Trifolium hybridum	24.3	14.2	2.67	2.85	2.44	0.48	104	134	24	74.0	33.2	10.3	1.34
Vicia cracca	16.3	14.4	2.08	2.59	2.08	0.40	90	208	32	117.2	32.7	7.7	3.30
Inula britannica	29.0	13.4	2.82	4.15	2.20	0.52	33	135	29	88.0	41.2	12.5	0.19
Matricaria maritima	23.8	9.2	4.42	3.37	2.20	0.48	210	227	22	68.8	28.1	9.8	0.62
Seneico jacobea	22.3	12.8	5.91	4.80	2.60	0.66	145	189	22	107.2	34.2	13.9	0.58
Xanthium italicum	24.3	27.8	4.89	8.49	3.00	0.56	98	235	34	68.8	85.4	18.5	0.29
Lycopus europaeus	33.3	12.6	3.47	5.86	2.64	0.64	99	193	89	176.0	41.0	17.0	0.49
Lycopus exaltatus	24.0	13.4	2.98	2.85	2.24	0.48	60	388	49	116.0	30.0	16.0	0.66
Stachys palustris	16.8	14.0	2.65	2.39	2.64	0.40	108	359	45	74.0	25.1	10.5	0.49
Oenanthe aquatica	27.3	18.4	4.28	7.85	2.80	1.40	73	324	79	88.0	28.9	14.7	0.42
Sium latifolium	40.0	13.6	3.91	6.49	2.28	1.24	50	73	56	44.8	23.4	13.1	0.40
Lythrum salicaria	16.5	15.8	2.62	0.19	2.64	0.52	121	254	63	172.8	24.1	9.8	0.34
Lythrum virgatum	14.8	12.8	3.26	2.97	2.40	0.40	69	149	31	184.0	22.8	9.5	0.18
Lysimachia vulgaris	16.5	12.4	1.77	2.76	2.36	0.44	65	237	28	31.2	18.1	4.2	0.23
Lysimachia vulgaris	15.8	5.8	1.96	2.15	1.76	0.40	91	141	65	28.0	19.4	7.4	0.27
Rorippa austriaca	15.8	16.0	2.46	5.66	1.64	0.48	196	263	20	88.0	39.9	4.0	0.32
Centaurium pulchellum	21.5	4.9	5.41	4.50	3.87	0.86	281	297	25	105.8		16.5	
Gratiola officinalis	25.8	12.8	2.65	7.12	2.64	1.16	65	465	29	122.4	24.7	13.5	0.43
Rumex crispus	21.8	9.0	2.35	1.90	2.48	0.96	41	76	48	28.4	20.0	6.5	0.44
Plantago major	27.5	28.4	4.22	8.64	2.64	0.48	76	128	20	80.0	30.4	9.8	0.43
Rubus caesius	17.3	10.6	2.62	3.17	2.80	0.44	31	217	36	43.6	32.7	8.6	0.21
Fraxinus pennsilvanica	10.8	8.0	3.64	2.75	2.24	0.48	26	127	18	28.0	23.4	8.0	0.10
Populus canadensis	15.3	9.4	2.92	4.03	2.48	0.48	37	90	23	200.0	30.4	9.7	0.08
Salix alba et *fragilis*	16.5	17.4	2.26	4.39	2.44	0.40	60	123	67	193.6	33.6	8.6	0.09

Table 2. *Tiszaszalka, 16. June 1978. From inundations and earthwork heavily cut-up surface; samples collected on places with differences*
minimally 6 m

	K	Ca	P	S	Mg	Na	Al	Fe	Mn	Zn	B	Cu	Mo
	g/kg								mg/kg				
Calamagrostis pseudophragmites	18.3	1.4	2.12	1.70	0.64	0.056	98	106	82	26.4	9.4	6.8	0.11
Typhoides arundinacea	21.0	2.2	2.35	2.44	1.00	0.028	10	81	14	23.2	5.0	3.6	0.08
Agrostis stolonifera	24.6	2.6	2.73	2.88	1.60	0.080	374	438	78	28.8	2.2	6.1	0.45
Agrostis stolonifera	27.9	3.6	3.59	4.05	2.24	0.088	344	910	120	38.0	6.5	8.6	0.27
Agrostis stolonifera	23.7	3.2	2.80	2.37	1.56	0.086	324	301	73	25.6	3.4	4.9	0.48
Agrostis stolonifera	19.5	3.0	2.19	2.15	1.60	0.088	578	840	141	16.8	3.8	5.5	0.42
Poa trivialis	18.3	3.2	2.97	2.51	1.24	0.108	510	1190	71	62.0	1.1	9.8	0.22
Poa trivialis	21.0	3.2	2.84	2.12	1.20	0.068	438	518	41	67.2	1.8	7.2	0.21
Poa trivialis	14.4	2.0	1.97	1.61	0.76	0.060	123	158	56	64.4	2.1	5.7	0.18
Phleum pratense	24.6	2.8	2.72	1.8	1.06	0.080	438	546	82	28.4	2.9	5.8	0.70
Phleum pratense	25.2	2.0	2.59	1.51	0.92	0.072	408	470	42	32.0	2.0	5.0	0.29
Agropyron repens	27.3	4.0	3.20	2.98	1.32	0.076	408	568	34	24.8	0.9	7.6	0.44
Lolium perenne	22.2	4.4	2.91	3.07	1.56	0.088	459	910	51	32.0	3.8	6.2	0.51
Festuca pratensis	13.5	3.6	1.79	1.68	0.76	0.036	319	350	32	28.0	3.1	3.1	0.48
Bromus inermis	25.5	3.2	2.93	2.93	1.28	0.040	117	155	25	27.2	3.2	7.4	0.21
Phragmites communis	21.0	4.0	2.36	4.44	0.76	0.128	111	172	43	57.2	0.9	7.6	0.40
Festuca pratensis	21.6	2.6	2.24	2.09	1.04	0.036	31	77	36	17.6	2.0	4.4	0.99
Lotus corniculatus	29.4	9.8	3.08	3.24	2.16	0.120	361	966	49	42.5	19.6	8.5	6.10
Lotus corniculatus	25.8	9.2	2.86	2.10	2.32	0.136	366	448	35	48.0	26.1	9.9	2.42
Lotus corniculatus	31.2	13.8	3.38	3.36	2.44	0.152	331	959	68	66.0	16.9	10.4	3.02
Trifolium campestre	16.2	10.6	1.84	2.85	1.64	0.080	586	1225	50	46.0	17.8	7.6	2.29
Trifolium repens	45.0	25.4	7.07	7.03	4.52	0.316	205	1330	170	96.0	29.1	17.1	1.72
Amorpha fruticosa	17.4	8.4	3.57	3.14	2.08	0.072	91	183	20	52.0	16.2	20.1	1.64
Trifolium pratense	30.3	18.6	3.19	3.34	3.72	0.084	246	264	40	66.0	30.2	17.6	2.52
Trifolium pratense	26.7	17.4	2.28	2.12	3.26	0.148	518	609	54	41.2	30.9	13.7	3.13
Vicia sp.	20.4	11.4	2.67	2.39	2.60	0.040	77	155	38	72.0	22.7	6.5	0.92
Rorippa prostrata	25.8	11.0	1.70	6.80	0.64	0.036	93	109	15	36.0	22.7	3.2	0.32
Lepidium ruderale	19.2	9.4	2.42	6.10	1.36	0.092	197	288	19	56.8	16.4	3.7	0.47
Matricaria inodora	23.4	7.8	1.98	2.29	1.80	0.060	145	165	26	35.2	20.1	5.1	0.34
Stenactis annua	28.2	8.8	3.95	3.17	1.40	0.064	438	1120	63	36.0	23.4	8.7	0.27
Artemisia vulgaris	39.0	13.8	3.48	2.49	2.60	0.096	238	372	70	96.8	43.2	29.7	0.ü6
Tanacetum vulgare	34.5	11.2	3.86	2.02	1.62	0.072	408	505	45	44.0	19.4	8.2	0.16
Echynocystis lobata	52.5	16.0	4.84	6.64	3.44	0.184	207	1330	50	60.8	18.0	12.6	0.34
Echynocystis lobata	40.2	13.6	5.44	4.34	3.60	0.164	279	1330	57	48.0	18.1	7.9	1.19
Echynocystis lobata	37.5	15.0	7.07	7.00	3.76	0.148	185	318	42	44.0	14.8	10.3	0.17
Aristolochia clematitis	33.6	11.4	4.13	3.83	2.92	0.048	85	139	46	46.0	22.5	16.0	0.20
Rubus caesius	18.6	9.4	3.20	2.80	3.52	0.064	317	434	40	42.8	22.3	3.6	0.22
Melandrium album	41.7	9.2	2.84	1.29	3.64	0.044	261	473	56	52.8	21.8	7.6	0.16
Salix purpurea	16.2	17.4	2.75	2.93	2.04	0.028	66	152	76	356.0	25.6	9.3	0.05
Salix fragilis	16.8	17.0	2.03	4.78	1.96	0.052	90	190	345	356.0	31.7	7.7	0.05
Salix alba	17.4	15.2	2.18	4.10	2.56	0.064	103	195	31	372.0	33.8	10.3	0.08
Populus alba	23.1	13.6	3.68	4.19	3.00	0.092	99	247	40	316.0	25.4	12.6	0.04
Populus deltoides	20.1	17.0	2.12	2.87	2.64	0.052	41	113	22	608.0	35.8	10.2	0.09
Fraxinus sp.	12.6	11.8	2.08	2.29	1.96	0.048	38	104	13	68.8	20.9	15.9	0.03
Fraxinus angustifolia ssp. *hungarica*	15.9	7.2	2.46	2.24	2.52	0.036	24	88	24	40.0	19.3	18.1	0.13

in Tiszafüred 65 ppm, and in Nagykörű 94 ppm average values were observed. It can not be stated that there exists an "anomaly"; if it exists, it concerns a longer reach. On the Upper-Tisza in Hungary Tölgyesi found in 14—16 June 1978 in Tivadar 36 ppm, in Gergelyiugornya 43 ppm, in Vásárosnamény 53 ppm, and in Tiszaszalka 85 ppm average zinc contents. This is lower than the values observed on the middle reach of the river. It should be sampled a greater area within a short time to discover possible industrial contamination. Such a surveying should be extended, however, to the affluents as well. Due to shortage in capacitity in collecting and analysing it would be necessary to restrict to some indicator plants. E.g. between copper contents in 21 samples of *Alisma plantago-aquatica* and copper contents of soil extracted according to Weterhoff a significant correlation was found ($n=21$, $r=0.44$). It could be attempted to use the zinc-accumulating capacity of the *Lycopus* and *Lythrum* species as well.

It can be established that on the area investigated plant nutrients occur in abundance. Mineral nutrients concentration in herbaceous plants is equal to that whiches may be considered as ideal. Abundant water supply and availability of nutrients is only one cause of this phenomenon; among others low calcium contents make possible uptake of manganese, zinc (and partly boron as well) with a higher efficiency. On the other hand the low organic matter accumulation (as contrasted to meadow soils) collects only moderate or sufficient quantity of molibdenum. Thus no excess of molibdenum or too small Cu per Mo ration injurious for phytophagous mammals occur.

From the stand-point of podder-chain very favourable composition is accompanied by high dry-matter production. All species are represented by big, virulent individuals. This is a rare and lucky coincidence of qualitative and quantitative indexes. While on alkaline soils high mineral contents of the vegetation is combined with low production, the field grown fodder plants shows a low (only in this ecosystem observable) contents of meso- and micro-elements. Favourable development of wild mammals in the forests of inundation area supports authors' observations. According to authors' supposition mineral constituents taken up by the grasses of the inundation area is only a fragment of the quantity which reaches the biotop by overground and underground water currents. Gathering hay of these biotops one part of the nutrients leaked from agricultural soils might be recuperated. The hay from the inundation areas is indispensable in feeding cattle. Corn silage contains only half while the vegetation of Abádszalók the double of the standard zinc concentration (40 ppm). Steady use (elimination) of the vegetation produce not only fodder rich in nutrients but at the same time "detoxify" the biotop. Thus heavy metals (useful in small quantities) can not accumulate excessively and can not disturb the balance of the ecosystem.

References

Kozma, A. and Tölgyesi, Gy. (1979): Plant associations of flood plains along the Middle Tisza and their agricultural utilization. — Tiscia (Szeged) *15,* 105—122.

Kozma, A. and Tölgyesi, Gy. (1979): Dunai ártéri területek növényeinek vizsgálata mezőgazdasági hasznosításuk, valamint makro- és mikroelem-tartalmuk szempontjából (Investigation of plants from the inundation area of the Danube from the stand-point of agricultural use andmacro- and micro—element contents). — Magyar Állatorvosok Lapja *34,* 158—163.

Kozma, A. and Tölgyesi, Gy. (1980): Investigation into the plant associations of the Tisza after passing of the spring floodwave in the flood plain at Abádszalók in 1979. — Tiscia (Szeged) *15,* 145—146.

TÖLGYESI, GY. (1965): Applicability of newest knowledge on the microelement content of plants in different fields of agricultural sciences. — Acta Agr. Hung. *14*, 287—301.
TÖLGYESI, GY.: Factors influencing the content of trace element in plants. Budapest. — Hilger Ltd., London (in preparation).
TÖLGYESI, GY. and KÁRPÁTI, I. (1977): Zala-menti réti növényzet tápanyagtartalmában megnyilvánuló néhány törvényszerűség 11 elem vizsgálata során (Some correlations in nutrient contents of the meadow vegetation along the river Zala based on investigation of 11 elements). — Agrokémia és Talajtan *26*, 63—78.
TÖLGYESI, GY. and KOZMA, A. (1974): A pázsitfüvek bórfelvételét befolyásoló tényezők (Factors influencing boron uptake of grasses). — Agrokémia és Talajtan *23*, 88—98.
TÖLGYESI, GY. and MAJOR, T. (1976): Macro- and microelement concentration in seeds of vegetables belonging to the family Cruciferae. — Acta Agr. Hung. *25*, 137—142.

Taxonómiai és ökológiai észrevételek ártéri növényfajok makro- és mikroelem koncentrációjával kapcsolatban

TÖLGYESI GY. és KOZMA A.

Állatorvostudományi Egyetem, Budapest, Magyarország

Kivonat

A Tisza középső szakaszán, Abádszalók mellett az ártéren gyűjtött 41 növényfaj 45 mintáját elemezték 13 elemre. Megállapítottak néhány taxonomiai összefüggést. Felhívják a figyelmet néhány akkumuláló fajra. Megállapították, hogy a növényzet a vizsgált elemekből nem tartalmaz toxikus mennyiségeket; bár a cinktartalom többszöröse a magyar flóra átlagának. Ezen tulajdonsága alapján a hullámtéri széna igen alkalmas a kis cinktartalmú szántóföldi takarmánynövények kiegészítésére.

Taksonomska i ekološka zapažanja koncentracije makro- i mikroelemenata na biljkama plavnih stani ta

TÖLGYESI GY. i KOZMA A.

Veterinarski fakultet, Budapest, Hungaria

Abstrakt

Analiza na prisustvo 13 hemijskih elemenata izvršena je sa 45 uzoraka 41 biljne vrste sa plavnog područja srednjeg toka reke Tise, pored naselja Abádszalók. Utvrdjena je izvesna taksonomska uslovljenost. Ukazano je na nekoliko akumulativnih vrsta. Autori su nadalje utvrdili da od analiziranih elemenata vegetacija ne sadrži toksičnu količinu, mada sadržaj Zn je višestruko iznad proseka u flori Madjarske. Na osnovu ovakvih svojstava seno sa plavnih područja se javlja kao značajna primesa krmnom bilju sa obradivih površina sa malom količinim Zn.

ТАКСОНИМИЧЕСКИЕ И ЭКОЛОГИЧЕСКИЕ ЗАМЕЧАНИЯ ОТНОСИТЕЛЬНО КОНЦЕНТРАЦИИ МАКРО- И МИКРОЭЛЕМЕНТОВ В РАСТЕНИЯХ РАЗВИВАЮЩИЕСЯ НА РАЗЛИЧНЫХ ТЕРРИТОРИЯХ РЕКИ

Д. Тёльдеши и А. Козма

Ветеринарный университет, Будапешт

Резюме

На различных территориях среднего течения р. Тисы вблизи Обадсалок было собрано 41 вид растений в 45 эксикатах, в которых разузнали и эпализировали по содержании 13 элементов. Между которыми обнаружили таксономические взаимосвязи, и подчеркнули некоторые аккумилативные виды.

Было определено, что растения из анализированных элементов не содержат токсические вещества, несмотря на то, что содержание цинка в них гораздо больше среднего содержания цинка венгерской флоры. На основании этого свойства растений, сено заливных лугов может послужить хорошим дополнением к кормовым растениям пахотных земель с малым содержанием цинка.

Tiscia (Szeged) Vol. XVIII, pp. 75—82 (1983)

ELEMENTARY COMPOSITION OF PLANTS ON THE INUNDATION AREAS OF THE RIVER TISZA BETWEEN TIVADAR AND TISZASZALKA

GY. TÖLGYESI

University of Veterinary Sciences, Budapest
(Received June 20, 1981)

Summari

Due to climate of Hungary meagre in rainfall overhelming quantity of meadow hay is produced on the inundation areas along the rivers. Knowledge of occurrence of valuable and toxic components in these hays is therefore very important. Until now concentration of macro- and micro elements in plant species along the rivers Zala (TÖLGYESI and KÁRPÁTI 1977), Danube (KOZMA and TÖLGYESI 1979), and the middle reach of Tisza (KOZMA and TÖLGYESI 1979) are published in detail. Examination of the upper reach of Tisza is essential because conditions on this area serve as comparison in estimation of the reaches of the river which are industrially, agriculturally and communally more burdened. In addition to problems of feeding, environment conservation and soil conservation observátion on chemotaxonomy and ecology can be discussed as well. In this way, apart from the circulation of nutrients in the region, regularities commanding general interest may be reviewed: accumulating species, deviations in uptake of elements on the same biotopes, positive and negative correlations in uptake of certain pairs of elements etc. Methods proved to be suitable in the last twenty years were used, so results can be directly compared with earlier data concerning the Hungarian flora.

Materials and Methods

Samples of plants were collected between 14 and 16 June 1978: in the case of herbaceous plants the whole overground part, in the case of ligneous plants a 35—40 cm long leafy twig. From at least 25 g dry matter average samples of each species 7 g were used for chemical analysis. The 123 samples represent 68 species of flowering plants. The elements were determined by atomic-absorption and colorimetric methods after destruction with perchloric acid. In the case of boron and molibdenum incineration pretreatment was used.

Results

From the stand-point of practice the vegetation as a whole makes a good impression (Table 1). In respect of plant physiology and plant cultivation all elements are present in suitable concentrations due to abundancy of mineral nutrients and water as well on the inundation areas. Symptoms of salt-accumulation (Mg, S, Na) or accumulation of heavy metals (Zn, Cu, Mo) does not occur. The composition can be considered as ideal for feeding cattle, except sodium and manganese contents. It should be completed with sodium to 1.7 g per kg and with manganese to 80 mg per kg to be up to standard.

Evalutaing data first a comparison with the average values of 4316 samples of 804 species of 54 families of the Hungarian flora will be performed (TÖLGYESI, unpublished). Important differences can be established only in the concentration of sodium and manganese, both being lower in the species along the Tisza. The low sodium uptake has two causes. The water of the river has a low salt contents and the relatively high relief energy favour more salt leakage than salt accumulation. On the other hand, this material does not include water plants (Hydrocharitaceae, Zosteraceae atc.) and other sodium-accumulating species (e.g. Chenopodiaceae). On the river banks investigated do not occur Cyperaceae and Juncaceae in greater quantities which contain more sodium than other taxa. The manganese contents lower than the average of Hungarian flora may be attributed to the lack of manganese accumulating families Fagaceae, Betulaceae, and Abietaceae and higher water plants the species of which contain sometimes thousandtimes more manganese than the other species found here.

Comparing the data with them of the vegetation of the inundation area of the Danube (KOZMA and TÖLGYESI 1979) no important differences are found in the case of Ca, Mg, Al, and Mn. Along the upper reach of the Tisza the vegetation of the inundation area contains much more potassium, phosphorous, sulfur, iron, zinc and copper than that along the Danube.

This can be attributed to the fact that the Tisza transports weathering products originating from the upper water basin mostly covered with crystalline and vulcanic rocks (PÉCSI 1969) while the Danube runs on greater parts on marine sediments. Molibdenum contents of the vegetation along the Tisza is only a fraction of that of the vegetation along the Danube. The cause of this is not the difference in molibdenum contents of the soils but the difference in chemical reaction of them. Reaction of sediments of the Danube is always alkaline while pH of sediments of the Tisza is 6.0—6.5. Uptake of molibdenum from acidic soils is more difficult. Similar differences due to differences in the quality of rock-bed and differences in chemical reaction were observed in vegetations living on forest soils as well (TÖLGYESI and CSAPODY 1973). Differences in the quantity of dissolved and suspended nutrients can be observed also in relatively short distances in the same river. E.g. TÖLGYESI and KÁRPÁTI (1977) measured in the vegetation of the inundation area on the upper reach of the river Zala a higher zinc and a lower molibdenum concentration than on the lower reach. The cause of this is leakage and accumulation of alkalies and alkaline earths which influence in different ways of the uptake of other elements.

It is important to answer the question wether any gradation of heavy metals indicating pollution can be observed on the areas investigated till now. For this purpose the data of Compositae are summarized. It was established that composites living in the section between Tivadar and Tiszaszalka contain in average 34 ppm zinc and 9.8 ppm copper while on the section between Tokaj nad Nagykörű they contain 89 ppm zinc and 15.2 ppm copper. Although latter values can not be considered as phytotoxic nor as disquieting in feeding, the rise of the concentration of these elements is indisputable. Disclosure of the heavy metal sources and establishment of their sphere of action needs further investigations. Based on recent experiences status quo can be ascertained by high sample density analysis of some ubiquitous species.

Pressed for space results of only one collection are presented in detail (Table 2). From the many possible taxonomic comments only some are mentioned: the low Ca and B contents of monocotyledons, high Mo-concentration in Papilionaceae, zinc accumulation in Salicaceae, intensive sulfur uptake of Cruciferae *(Rorippa, Lepidium)*, etc. Even between closely related taxa definite chemical differences can be observed. E.g. *Agrositis stolonifera* differs from *Poa trivialis* by higher manganese and lower zin contents. The Cu/Mo ration in *Lotus corniculatus* is in average 2.49 while in *Trifolium pratense* it is more than the double: 5.55. Naturally, these characters are observable in other circumstances as well due to the relative constancy of ion uptake of plants (TÖLGYESI 1965).

Mineral nutrition of plants living on the same soil shows correlation depending in the first libe on internal factors. From the 78 correlation coefficients calculated from the elementary composition of 45 samples of Tiszaszalka 33 show significancy (Table 3). Correlations above a value of 0.28 are significant on $P=0.05$ level while above a value of 0.46 on $P=0.001$ level. From the interpretable connections positive correlation between alkaline earth ions (Ca—Mg), trivalent cations (Al—Fe) and important anione-forming elements (P—S) can be mentioned.

It is important to know from the stand-point of theory and practice as well, which elements show a higher and which a lower variance on the investigated areas of about one hundred square metres. To illustrate this from data of Table 1. the values of variancy coefficients are grouped according to biotops and elements in descending sequence (Table 4). It is appearent that concentration of phosphorus and potassium slightly depends on specific affiliation, the CV-values are low. In contrast to this taxonomic position of the plants much more significantly influences the concentration of zinc, iron, and molibdenum. Therefore, in the case of low sample numbers only identical or closely related species may be compared. For the present can not be interpreted the lack of expression of the variance of manganese concentration (average $CV=52.9$) which shows otherwise a very high variability. In general, manganese is one of the most variable micro-elements from standpoint of taxonomy and ecology as well; in the Hungarian vegetation values between 6 and 50 000 ppm (differences of four order of magnitude!) were observed.

Summarizing the most important results it can be established that the vegetation of the inundation areas along the upper reach of the river Tisza in Hungary is rich in nutrients and as fodder it is nearly perfect. Accumulation of heavy metals can be excluded in the time of sampling as contrasted to the earlier investigated lower reaches. Investigations increasing the number of sampled places are continued.

*

Author gives thanks Zs. TÖLGYESI for his help in collecting the samples and *Rózsa Gerics* for her contribution in the analysis.

Table 1. *Average values and standard deviations of plant species collected on the inundation area of the Upper-Tisza on 14—16 June 1978*

site		K	Ca	P	S	Mg	Na	Al	Fe	Mn	Zn	B	Cu	Mo
		g/kg						mg/kg						
Gergelyiugornya	$\bar{x}$	24.3	8.8	3.84	2.53	2.24	0.069	412	567	57.2	43.1	16.6	11.3	0.56
n=14	s ±	4.54	3.85	0.76	0.74	0.74	0.030	130.6	480.1	24.6	19.7	5.34	5.77	0.39
	CV	18.7	43.6	19.9	39.2	33.1	44.7	61.7	8.47	42.9	45.7	32.2	51.2	69.5
Tiszaszalka	$\bar{x}$	25.1	9.1	3.03	3.20	1.90	0.084	248	480	58.3	85.4	16.2	9.27	0.77
n=45	s ±	8.83	5.84	1.18	1.50	1.12	0.052	165.9	395	53.8	119.7	11.6	5.27	1.15
	CV	35.2	63.8	38.9	46.9	59.0	61.9	66.7	82.35	92.2	140.1	71.7	56.9	150.1
Tivadar I.	$\bar{x}$	23.8	9.4	3.62	3.11	2.13	0.060	170.5	300.8	35.0	36.5	11.9	10.3	0.84
n=28	s +	6.00	4.67	0.87	1.50	0.82	0.026	135.5	251	19.5	38.9	6.67	6.12	0.74
	CV	25.2	49.5	24.2	48.1	38.7	44.3	49.5	83.6	55.6	106.8	55.9	59.3	87.9
Tivadar II.	$\bar{x}$	20.5	10.1	2.62	2.98	2.36	0.066	292	380	52.6	33.8	15.3	7.86	0.127
n=23	s ±	4.58	6.00	0.78	1.44	0.99	0.028	186.7	312.7	29	31.2	7.86	2.76	0.03
	CV	22.4	59.6	29.6	48.1	42.3	42.6	63.8	82.2	44.6	92.4	51.4	35.1	101.3
Vásárosnamény	$\bar{x}$	21.5	9.8	2.82	3.02	1.94	0.065	89	153	21	52.6	11.7	7.6	0.64
n=13	s ±	5.34	4.80	1.20	1.70	0.94	0.029	39.5	42.6	6.1	71.3	6.7	3.16	0.22
	CV	24.8	48.9	35.3	56.4	48.2	44.5	44.2	27.9	29.0	135.5	57.4	41.4	34.9

Table 2. *Correlations between contents of mineral-nutrients of samples collected in Abádszalók on 28 June 1979*
($M=45$; $P_{0.05}=0.28$)

	Ca	P	S	Mg	Na	Al	Fe	Mn	Zn	B	Cu	Mo
K—	*0.43*	0.11	−0.03	*0.34*	0.19	0.06	0.14	−0.05	0.14	*0.32*	*0.49*	−0.12
Ca—		*0.45*	*0.58*	*0.57*	−0.04	−0.03	*0.33*	−0.20	*0.30*	*0.78*	*0.37*	−0.09
P—			*0.57*	*0.65*	−0.15	*0.31*	*0.34*	*−0.34*	0.25	*0.57*	*0.54*	−0.15
S—				0.03	0.07	0.18	−0.08	−0.13	0.24	*0.51*	*0.46*	−0.14
Mg—					−0.02	0.22	*0.48*	−0.11	*0.36*	*0.67*	*0.58*	0.16
Na—						0.04	−0.15	*0.59*	−0.20	−0.24	0.11	0.08
Al—							*0.45*	0.06	−0.03	0.08	*0.03*	0.17
Fe—								−0.17	*0.31*	*0.34*	*0.45*	−0.03
Mn—									−0.20	*−0.29*	−0.07	−0.03
Zn—										0.23	0.03	0.11
B—											*0.47*	0.09
Cu—												−0.08

Table 3. *Correlations in mineral contents of 45 samples (mostly consisting if different species), each representing individuals of one species on the site of Tiszaszalka in June 1978*

	Ca	P	S	Mg	Na	Al	Fe	Mn	Zn	B	Cu	Mo
K—	0.42	0.74	0.42	0.58	0.62	0.12	0.49	0.07	−0.19	0.28	0.32	0.16
Ca—		0.45	0.53	0.77	0.47	−0.21	0.16	0.22	0.49	0.86	0.51	0.25
P—			0.57	0.63	0.31	0.04	0.47	0.20	−0.11	0.20	0.36	0.07
S—				0.36	0.53	0.24	0.22	0.19	0.14	0.27	0.11	0.0
Mg—					−0.64	−0.06	0.27	0.10	0.20	0.66	0.52	0.25
Na—						0.27	0.66	0.23	−0.11	0.19	0.30	0.40
Al—							0.68	0.12	−0.37	−0.19	−0.17	0.31
Fe—								0.22	−0.27	−0.01	0.03	0.36
Mn—									0.22	0.12	0.02	−0.03
Zn—										0.52	0.14	−0.19
B—											0.56	0.18
Cu—												0.13

Table 4. *Coefficients of variance ordered in decreasing sequence of CV-values from the collections of Upper-Tisza in 1978*

Site		1	2	3	4	5	6	7	8	9	10	11	12	13
Gergelyiugornya		Fe	Mo	Al	Cu	Zn	Na	Ca	Mn	Mg	B	S	P	K
n=14	CV	84.7	69.5	61.4	51.2	45.7	44.7	43.6	42.9	33.1	32.3	29.2	19.9	18.7
Tivadar I.		Zn	Mo	Fe	Al	Cu	B	Mn	Ca	S	Na	Mg	K	P
n=28	CV	106.8	87.9	83.6	79.5	59.3	55.9	55.6	49.5	48.1	44.3	38.7	25.2	24.2
Tivadar II.		Mo	Zn	Fe	Al	Ca	B	S	Mn	Na	Mg	Cu	P	K
n=23	CV	101.3	92.4	82.2	63.8	59.6	52.4	48.1	44.6	42.6	42.3	35.1	29.6	22.4
Tiszaszalka		Mo	Zn	Mn	Fe	B	Al	Ca	Na	Mg	Cu	S	P	K
n=45	CV	150.1	140.1	92.2	82.3	71.7	66.7	63.8	61.9	59.0	56.9	46.9	38.9	35.2
Vásárosnamény		Zn	B	S	Ca	Mg	Na	Al	Cu	P	Mo	Mn	Fe	K
n=13	CV	135.5	57.4	56.4	48.9	48.2	144.5	44.2	41.4	35.3	34.9	29.0	27.9	24.8

References

KOZMA, A. and TÖLGYESI, GY. (1979): Plant associations of flood plains along the Middle Tisza and their agricultural utilization. — Tiscia (Szeged) *14*, 105—122.

KOZMA, A. and TÖLGYESI, GY. (1979): Dunai ártéri területek növényeinek vizsgálata mezőgazdasági hasznosíthatóságuk, valamint makro- és mikroelem-tartalmuk szempontjából (Examination of plants from tide lands of the Danube for their agricultural utility and macro- and microelement contents). — Magyar Állatorvosok Lapja *34*, 158—163.

PÉCSI, M. (ed.) (1969): A tiszai alföld (The lowland of Tisza). — Budapest.

TÖLGYESI, GY. (1965): Applicability of newest knowledge on the microelement content of plants in different fields of agricultural sciences. Acta Agr. Hung. *14*, 287—301.

TÖLGYESI, GY.: Factors influencing the content of trace elements of plants. — Budapest, — Hilger Ltd. London (in press.).

TÖLGYESI, GY. and KÁRPÁTI, I. (1977): Zala-menti réti növényzet tápanyagtartalmában megnyilvánuló néhány törvényszerűség 11 elem vizsgálata során (Some correlations in nutrient contents of the meadow vegetation along the river Zala based on investigation of 11 elements). — Agrokémia és Talajtan *26*, 63—78.

TÖLGYESI, GY. and CSAPODY, I. (1973): Sopron környéki kőzethatású, valamint közép- ést délkelet-európai barna erdőtalajok természetes növényzetének tápanyag felvétele (Nut rien uptake of the natural vegetation of the litomorphic brown forest soils in the Sopron region and of the brown forest soils in Central- and South-Eastren Europe). — Agrokémia és Talajtan. *22*, 129—152.

Ártéri növényfajok elemi összetétele a Tisza Tivadar és Tiszaszalka közötti szakaszán

TÖLGYESI GY.

Állatorvostudományi Egyetem, Budapest, Magyarország

Kivonat

Öt cönózisból gyűjtött 68 virágos faj 123 mintájában 13 kémiai elemet határoztak meg. Megállapítható, hogy a Tisza magyarországi felső szakaszán a növényzet tápanyagokban gazdag, de toxikus mennyiségű nehézfém mennyiséget nem tartalmaz. A cink és a réz koncentrációja jelentősen kisebb, mint Tokaj és Nagykörű között. Az adatok között számos kemotaxonomiailag is értékelhető összefüggés van. Az azonos módon vizsgált dunai növényzettel szemben jellemzően nagyobb K, P, S, Zn és Cu koncentrációk mérhetők, míg a Mo-tartalom kisebb.

Hemijski sastav biljaka plavnih područja sa deonice reke Tise izmedju Tisza Tivadar i Tiszaszalka

TÖLGYESI GY.

Veterinarski fakultet, Budapest, Hungaria

Iz 5 fitocenoza putem 123 izvršene analize na 68 cvetnica, utvrdjeno je prisustvo 13 hemijskih elemenata. Konstatovano je da je vegetacija na gornjoj deonici reke Tise bogata hranljivim sastojcima, i da ne sadrži toksičnu količinu teških metala. Koncentracija Zn i Cu je znatno niža od one deonici izmedju Tokaj-a i Nagykörü. Medju podacima s nalazi veliki broj značajnih i u hemotaksonomskom pogledu. U odnosu sa istom metodom analiziranu vegetaciju Dunava, konstatovana je ve a koncentracija K, P, S, Zn, Cu, dok je količina Mo manja.

ЭЛЕМЕНТНЫЙ СОСТАВ ВИДОВ РАСТЕНИЙ В ЗАПЛАВЕ РЕКИ ТИСЫ МЕЖДУ ТИСА ТИВАДАР И ТИСА САЛКА

Д. Тёльдьеши

Ветеринарный университет, Будапешт

Резюме

В 123 образках, 68 видов цветковых растений, собранных из пяти ценозов, были обнаруи жены 13 химические элементы. Можна констатировать, что на верхнем участке реки Тисы в пределах Венгрии, растительность богата на минеральные элементы, однако не содержит тяжелые металлы, в таком количестве, чтобы оно могло иметь токсическое действеи. Концентрация цинка и меди здесь значительно меньше, чем между Токаем и Надькерю. Сред-данных существует взаимосвязь, которая может быть оценена и хемотаксономически. По сравнению с дунайской растительностью, здесь значительно больше концентрация K, P, S, Zn, и Cu при чем содержание Mo меньше.

Tiscia (Szeged) Vol. XVIII, pp. 83—95 (1983)

HISTORY OF THE INVESTIGATION OF THE TERRESTRIAL SNAILS OF THE GREAT HUNGARIAN PLAIN AND ITS PRESENT SITUATION. II

K. BÁBA

Department of Biology, Gyula Juhász Teachers' Training College, Szeged
(Received September 1, 1981)

Summary

Number of species of the terrestrial snail-fauna of the Great Hungarian Plain is 73 after omitting species occuring only on civilized places, already extincted, occuring only accidentally on the inundation areas, or only outside the borders and disregarding dubious data of the publications. Analysis was performed on 19 356 individuals.

Three stand-points of analysis were selected: 1. number of individuals and frequency of occurrence in the plant associations of zonal and azonal places (within this the occurrence on one place only: constantly or temporarily), 2. fauna — transporting activity of the rivers and expansion through forests, 3. environmental requirements of the species.

In the first part of this work a list with 97 species was published. From these species *Orcula Pomatias elegans, Acicula polita, Truncatellina claustralis, Ruthenica filograna,* and *Discus rotundatus* became extinct on the Great Hungarian Plain. Adherents of civilization are *Oxychilus hydatinus* and *Milax budapestinensis;* they do not occur in the nature. *Ena obscura, Macrogastra ventricosa, Clausilis dubia, Laciniaria plicata, Arion dasciatus, Vitrea diaphana, Aegopis verticillus, Oxychilus inopinatus, Bielzia coerulans, Trichia striolata, Isognomostoma isognomostoma* were found only once; regardinf their requirements no permanent establishment is to be expected, author considers them as statistically accidental elements. "Permanent" members of the fauna fo the Great Hungarian Plain.

On the basis of the earlier published data and diminishing of the sedimental faunas /auna impoverishment can be established since the beginning of the century. The cause of this are drainage, lumbering, river control and other cultural effects. The fauna is dynamic (changing) at present as it was changing in the past, partly by new immigrations with the aid of the rivers and partly by cultural effects.

The first and second part of the work is cpmpleted by a survey of publications on the terrestrial snails of the Great Hungarian Plain.

Introduction

List of species published in the first part of this work desires an analysis from different stand-points. Therefore analysis must be extended to the investigation of the qualitative composition, to the distribution of the fauna in space and to its connections with the vegetation, to the recent and the reconstructed fauna as well.

Ecological and coenological analysis of the species and comparison of the faunas of the different regions are not included into the task of this paper.

Methods of analysis

Basis of the analysis are the collections performed with the aid of absolute methods in the forests two extrazonal (organogeneous and mineralogeneous) and one zonal (sand) succession series (BÁBA 1980a, the first part of this work). Investigating nearly 400 forests (in 100 of them no snails were found) 16 859 individuals were collected, to this is added the material of 370 soil-traps containing 2487 exemplares; altogether 19 356 individuals. For the material of the traps author expresses thanks I. Loksa. Author's own material (71 species) was completed with the data of PINTÉR, RICHNOWSZKY and SZIGETHY (1979) plotted in the UTM-system (the book contains a part of author's own data as well).

To the reconstruction of the fauna a part of data from before 1950 were also considered (GEBHARDT 1961, ROTARIDES 1927, collection-diary of CZÓGLER. Soós 1915, 1928, 1943, VÁGVÖLGYI 1953, WAGNER 1938). The recent fauna can not be separated from the bygone one. By comparative analysis the changes can be measured. The analysis includes mainly the fauna of the Great Hungarian Plain. It is also necessary to mention the data of author's collections in Ruma nie and Czeschoslovakia and the.data of Soós (1943) obtained outside of the borders of the country.

Possibilities for evaluation of the recent fauna were provided by the analysis of the sediment fauna (BÁBA 1979). Population of the zonal and azonal biotopes were performed by contact of the rivers and mountain forests with the forests of the plains; this provides the relative constancy and at the same time the constant variance of the faunas. The analysis in 1979 was performed on 36 290 individuals of 117 species.

Analysis of the fauna is based on living exemplares (except in the fauna reconstruction, e.g. Pomatias elegans). Data published by PINTÉR, Richnowsky and Szigethy (1979), PINTÉR and Szigethy (1980) and by author and his colleagues are quoted by the GRIED-code. In the case of author's own data the locality is given.

Results and discussion

Composition of the fauna

Species introduced in glass houses, gardens, church-yards, parks are not included into the fauna. Such are: *Orcula doliolum* (BURG.); KOVÁCS (1974) found it a s sub-fossilium (in the list of species of the first part it was incorrectly included), *Discus rotundatus* (O.F.M.) (DS *32*), *Oxychilus hydatinus* (RM.) (ES *16, 17*), *Milax budapestiensis* (HAZAY) (ES ä*8, 16, 17,* CT *55*); in 1980 it was found in a garden in Újszeged (det. A. VARGA). There are also species which occure not only in civilized places but in the nature as well. Such are *Arion hortensis, Oxychilus inopinatus* (ES 16Q
places but in the nature as well. Such are *Arion hortensis, Oxychilus inopinatus* (ES *16, 17* on civilized places but FU *02* and in the environments of Szabadkígyós KOVÁCS found it in the nature), *Limax flavus* (DS *32,* DT *16,* ES *17,* ET *56* on civilized places, EU *93* in the nature), *Limax tenellus* (ES *16* on civilized place but EU *04* and in Bockerek in the nature), *Limax maximus* (on the Dráva Plain and n the Northern Plain in the nature), *Deroceras reticulatum* (DS *09,* DT *16,* ES *08,* ES *27* on civilized places in Temesköz, Isaszeg Mártonberek in the nature), *Cepaea nemoralis* (DS *75* in a church-yard, YL *89* in the nature), *Cepaea hortensis* (DS *69* in a church-yard, on the Danube bank e.g. CT *68* in the nature, Soós (1915) mentions it from Nagymihály, CSIKI (1902) from Püspökfürdő; its occurrence here should be controlled), *Helix lutescens* (it was collected in many places of the Great Hungarian Plain, its occurrence in church-yards and prks in comitat Békés is possible e.g. ES *07, 15, 16, 17*).

Inclusion into the fauna of the Great Hungarian Plain is problematic in the case of two species: *Arion fasciatus* (ES *26* from civilized place, CT *83* probably from the nature). ROTARIDES (1927) published *Arion ampiricorum* from the forest of Deszk; it is probably *Arion fasciatus.*

It is not elucidated even in the last published list (except author's own collections) whether the species was found as a living exemplare or dead in the sediment. E.g. *Ena obscura* (FU ä*3,* Csaroda) and *Helicogona arbustorum* (DS *29,* Lakitelek: Szikra) were plotted on the maps probably by AGÓCSY. Author collected *Ena obscura* in 1973 in Mártonberek in a forest of the Great Hungarian Plain bordering the hill-country of Gödöllő. Similarly, it is unknown whether *Zebrina detrita* and *Trichia unidentata* in CT *58* were living or found in sediment (PINTÉR and SZIGETHY 1980).

Cochlicopa nitens occurring in Petneháza and Mezőföld (EZ *82*, BR *92*) (Table I) is a new species in the list.

Similar to *Orcula doliolum*, *Pupilla sterri* (VOITH.) also should be striked from the list because in the Szatmár-Bereg Plain only a fresh but dead exemplare was found.

From species occurring outside the border following data should be omitted: *Daudebardia transsylvanica* (CLESS.) in Püspökfürdő (MOCSÁRY 1872), *Daudebardia calophana* (WEST.) in a hornbea m-oak forest in a valley bordering the plain in Rumania, *Trichia villosula* (RM.) in Munkács (TRAXLER 1894), *Macrogastra latestriata* (A. SCHMIDT) in Arad (CSIKI 1902). Omitting these species and added to the list *Cochlicopa nitens* as a new species the fauna of the Great Hungarian Plain contains 91 terrestrial snail species. From these further species should be omitted based on the frequency of occurrence. The species collected and data of their occurrence plotted on UTM maps were published earlier (BÁBA 1980).

Constancy of the fauna

In connection with this three factors are to taken into consideration: 1. Abundancy and frequency of occurrence in the plant associations of the different zonal and azonal biotopes. 2. Fauna-transporting activity of the rivers and expnasion through forests in the direction of hill-countries (BÁBA 1979). 3. The ecological requirements of the species.

The fauna should be continuously changing inaccordance with the region and its climatic and hydrographic characters and the natural and cultural effects. Meaning by the latters the presence and absence of plant associations in which the organisms can meet their requirements (shadow, humidity). As accidental elements expanding through the forests should be considerel *Ena obscura, Deroceras reticulatum* and *Trichia hispida* (from the direction of the hill-cpuntry of Gödöllő), *Perforatella incarnata, Euomphalia strigella, Vitrea crystallina, Aegopinella pura* and the *Nesovitrea* species (from the direction ofthe inundation area of the Danube on the Solt Plain and on the area between Danube and Tisza. The sandy and marshy forests (Table I. columns 2, 3) expanding at the beginning of this century as far as the forests along the Danube. The same is the situation in connection with the species expanding with the mineralogeneous succession; species of the corresponding requirements were transferred into forest types receding from the rivers due to the depositions (e.g. even at present on the Northern Plain). As an example can be mentioned the similarity of the faunas of the groves, the hornbeam-oak forests and the oak forests with convallaria which re frequently bordering each other).

Species expanding with the aid of water on the mineralogeneous areas can be distributed into accidental, temporarily settled and permanently settled elements. Species belonging to these three groups can be changed according to place and circumstances. Animals washed away from the hill-countries or from the mountains and getting on the river banks denuded by embankment, river control, and lumbering will perish while different species can be settled where williow-groves willow-poplargroves or gallery forests are along the river banks assuring an adequate micro-climate. The most rich in species are now the Dráva Plain, the Danube valley, the Plain of Szatmár-Bereg and the Nyírség. Here are relatively extended forests along the rivers.

Table I. *Number of individuals of the snails of the Great Hungarian Plain in different biotopes*

	1	2	3	4	5	6	7	8
1. *Pomatias elegans* (O. F. MÜLL.)	12	—	12	—	—	—	1	—
2. *Pomatias rivulare* (EICHW.)	27	—	27	—	—	—	1	+
3. *Acicula polita* (HARTM)	+	—	—	+	—	—	1	—
4. *Carychium minimum* (O. F. MÜLL.)	557	—	243	314	—	—	5	+
5. *Carychium tridentatum* (RISSO)	175	—	14	161	—	—	6	+
6. *Cochlicopa lubrica* (O. F. MÜLL.)	918	21	53	844	—	—	7	+
7. *Cochlicopa lubricella* (PORRO.)	145	70	17	58	—	—	5	+
8. *Cochlicopa nitens* (GALLENSTEIN)	+	—	—	—	—	—	1	+
9. *Columella edentula* (DRAP.)	228	35	5	188	—	—	5	+
10. *Truncatellina cylindrica* (FR.)	212	198	—	14	—	—	5	+
11. *Truncatellina claustralis* (GREDL.)	+	—	—	+	—	—	1	—
12. *Vertigo augustior* (JEFFR.)	17	8	3	6	—	—	5	+
13. *Vertigo pusilla* (O. F. MÜLL.)	19	12	—	7	—	—	3	+
14. *Vertigo antivertigo* (DRAP.)	54	—	52	2	—	—	3	+
15. *Vertigo moulinsiana* (DUPU)	+	—	—	+	—	—	1	+
16. *Vertigo pygmaea* (DRAP.)	3	1	2	—	—	—	2	+
17. *Granaria frumentum* (DRAP.)	470	462	1	6	—	—	5	+
18. *Pupilla muscorum* (L.)	98	89	—	9	—	—	3	+
19. *Vallonia pulchella* (O. F. MÜLL.)	631	133	51	447	—	—	8	+
20. *Vallonia costata* (O. F. MÜLL.)	1 556	1060	146	350	—	—	11	+
21. *Acanthinula aculeata* (O. F. MÜLL.)	23	9	—	13	—	—	4	+
22. *Chondrula tridens* (O. F. MÜLL.)	66	56	—	10	—	—	5	+
23. *Ena obscura* (O. F. MÜLL.)	1	1	—	—	—	—	1	—
24. *Cochlodina laminata* (MONTAGU)	70	—	—	70	—	—	1	+
25. *Ruthenica filograna* (ROSSM.)	+	—	—	+	—	—	1	—
26. *Macrogastra ventricosa* (DRAP.)	+	—	—	+	—	—	—	—
27. *Clausilia dubia* (DRAP.)	+	—	—	+	—	—	1	—
28. *Clausilia pumila* (C. PFEIFF.)	27	—	—	27	—	—	2	+

	1	2	3	4	5	6	7	8
29. *Laciniaria plicata* (DRAP.)	+	—	—	+	—	—	1	—
30. *Laciniaria biplicata* (MONTAGU)	17	—	—	17	—	—	3	+
31. *Succinea putris* (L.)	271	—	3	268	—	—	4	+
32. *Succinea oblonga* (DRAP.)	1 185	15	346	824	—	—	8	+
33. *Succinea elegans* (RISSO)	131	—	36	95	—	—	7	+
34. *Cecilioides acicula* (O. F. MÜLL.)	1	—	—	1	—	—	1	+
35. *Punctum pygmaeum* (DRAP.)	162	50	27	85	—	—	7	+
36. *Discus rotundatus* (O. F. MÜLL.)	+	—	—	+	—	—	1	—
37. *Arion hortensis* (FR.)	12	—	1	11	—	—	4	+
38. *Arion cirkumscriptus* (JOHNSTON)	59	3	—	56	—	—	5	+
39. *Arion fasciatus* (NILSSON)	+	—	—	—	—	—	—	—
40. *Arion subfuscus* (DRAP.)	877	19	—	76	24	758	6	+
41. *Vitrina pellucida* (O. F. MÜLL.)	1 161	704	86	371	—	—	8	+
42. *Zonitoides nitidus* (O. F. MÜLL.)	1 005	1	171	833	—	—	10	+
43. *Vitrea crystallina* (O. F. MÜLL.)	542	1	18	523	—	—	6	+
44. *Aegopis verticillus* (LAM.)	—	—	—	—	—	—	—	—
45. *Aegopinella pura* (ALDER)	189	2	3	44	140	—	3	+
46. *Aegopinella minor* (STABIÉE)	677	74	—	595	—	8	4	+
47. *Aegopinella ressmanni* (WEST.)	31	—	—	31	—	—	1	+
48. *Nesovitrea hammonis* (STRÖM)	403	89	87	225	1	2	7	+
49. *Oxychilus draparnaudi* (BECK)	30	—	—	30	—	—	1	+
50. *Oxychilus hydatinus* (RM.)	+	—	—	—	—	—	—	—
51. *Oxychilus glaber* (RM.)	197	6	—	191	—	—	2	+
52. *Oxychilus inopinatus* (ULIN)	1	—	—	1	—	—	1	—
53. *Daudebardia rufa* (DRAP.)	2	—	—	2	—	—	1	+
54. *Milax budapestiensis* (HAZAY)	+	—	—	—	—	—	—	—
55. *Limax nyctelius* (BOURG.)	8	—	—	8	—	—	2	+
56. *Limax tenellus* O. F. MÜLL.	9	—	—	9	—	—	3	+
57. *Limax maximus* (L.)	14	—	—	14	—	—	2	+
58. *Limax cinereoniger* (WOLF.)	1 006	1	1	37	15	952	6	+

	1	2	3	4	5	6	7	8
59. *Limax flavus* (L.)	3	—	—	3	—	—	1	+
60. *Bielzia coerulans* (M. BIELZ)	+	—	—	+	—	—	—	—
61. *Lehmania marginata* (O. F. MÜLL.)	38	—	—	—	3	35	2	+
62. *Deroceas laeve* (O. F. MÜLL.)	48	—	9	36	—	3	4	+
63. *Deroceras reticulatum* (O. F. MÜLL.)	10	1	—	9	—	—	4	+
64. *Deroceras agreste* (L.)	314	33	18	203	1	59	7	+
65. *Euconulus fulvus* (O. F. MÜLL.)	126	73	31	21	1	—	10	+
66. *Bradybaena fruticum* (O. F. MÜLL.)	927	20	374	454	—	79	8	+
67. *Helicella obvia* (HARTM.)	752	752	—	—	—	—	3	+
68. *Helicopsis striata* (O. F. MÜLL.)	118	118	—	—	—	—	4	+
69. *Monacha cartusiana* (O. F. MÜLL.)	231	195	27	9	—	—	5	+
70. *Perforatella bidentata* (GM.)	121	—	3	118	—	—	3	+
71. *Perforatella dibothrion* (M. KIM.)	11	—	—	11	—	—	3	+
71. *Perforatella rubiginosa* (A. SCHMIDT)	1 074	1	166	907	—	—	6	+
73. *Perforatella incarnata* (O. F. MÜLL.)	305	1	48	256	—	—	6	+
74. *Perforatella vicina* (RM.)	848	1	—	484	8	355	5	+
75. *Perforatella umbrosa* (C. PFEIFF.)	+	—	—	+	—	—	—	+
76. *Hygromia transsylvanica* (WEST.)	5	—	—	5	—	—	2	+
77. *Hygromia kovacsi* VARGA—PINTÉR	229	—	—	229	—	—	1	+
78. *Trichia unidentata* (DRAP.)	+	—	—	+	—	—	1	+
79. *Trichia striolata danubialis* (CLESSIN)	—	—	—	—	—	—	—	—
80. *Trichia hispida* (L.)	17	1	—	16	—	—	3	+
81. *Euomphalia strigella* (DRAP.)	141	9	4	128	—	—	8	+
82. *Helicigona banatica* (RM.)	89	—	—	89	—	—	1	+
83. *Helicigona planospira* (LAM.)	+	—	—	+	—	—	—	+
84. *Helicigona arbustorum* (L.)	15	—	—	15	—	—	2	+
85. *Isognomostoma isognomostoma* (SCHRÖTER)	1	—	—	1	—	—	1	—
86. *Cepaea vindobonensis* (FR.)	384	159	104	113	—	8	13	+
87. *Cepaea nemoralis* (L.)	12	—	—	12	—	—	1	+

	1	2	3	4	5	6	7	8
88. *Cepaea hortensis* (O. F. MÜLL.)	3	—	—	3	—	—	2	+
89. *Helix pomatia* (L.)	166	22	—	130	—	14	6	+
90. *Helix lutescens* (RM.)	38	—	—	35	—	3	3	+
Altogether:	19 356	4506	2152	10 187	193	2294	73	—

1. Total number of individuals (not own collections marked with a dagger).
2. From sandy grasses (succession from *Brometum tectorum* to *Quercetum roboris convallarietosum* on the Danube—Tisza Plain and on the Nyírség).
3. From the forests of the organogeneous succession series (Danube—Tisza Plain, Danube Plain, Nyírség, Szatmár—Bereg Plain).
4. From the forests of the mineralogeneous series of succession series (from willow-groves to hornbeam-oak-groves) in all regions of the Great Hungarian Plain.
5. From the spil traps in *Cariceto elongatae-Alnetum.*
6. From the soil-traps of the gallery forests (both from the forest complex of Bockerek).
7. Number of forest associations in which the species occur.
8. Fauna of the Great Hungarian Plain excluding accidental, dubious species and those of civilized places.

As accidental elements should be considered *Macrogastra ventricosa* (found in 1936 in the forest of MAGYAR), *Clausilis dubia* (found by GEBHARDT in 1961), *Trichia striolata* and *Aegopis verticillus.* Also to these should be pigeonholed *Oxychilus inopinatus* occurring along the Upper-Tisza, *Vitrea diaphana* observed along the Upper Tisza, *Vitrea diaphana* observed along the Upper-Tisza and along the Dráva (GEBHARDT 1961), *Vitrea contracta* (ET *40,* YL *89* along the Dráva, GEBHARDT 1961), *Isognomostoma isognomostoma* found in Szeged and Bielzia (EU *21* in Tiszavasvár) (if the latter was correctl identified). All these species should be striked off due to their accidental occurrence.

Species collected by the author and those collected on the forey of the Malacologist Meeting in Barcs (considering correctness of identification of the species collected by GEBHARDT 1961) should be accepted; these are: *Clausilia pumila, Daudebardia rufa, Perforatella umbrosa, Helicigona planospira, Helicigona arbustorum.* Number of species is therefore 83.

Changes in the fauna

Changes of environments in the last century affected the terrestrial snail fauna of the Great Hungarian Plain. Four forms of changes were important: 1. regulation of the rivers, 2. deforestation, 3. clear-felling in the central range of mountains in the water basin of the rivers, 4. canalization and drainage intensified from 1930.

The changes can be evaluated on the basis of three facts. The quantity of Mollusca in deposits in the environments of Szeged and along the Maros found by CZÓGLER and ROTARIDES (1938) exceeds their present quantity. The forests on the water basins have diminished.

On several points of the Great Hungarian Plain faunas were found similar to that of Bátorliget (although somewhat poorer) with *Perforatella vicina, Perforatella bidens, Perforatella dibotrion* and *Vitrea crystallina.* Species observed in the distant forests draw attention to unexploredness of the area and at the same time they exemplify the riginal snailfauna of the Great Hungarian Plain having been covered originally with continuous forests and uncontrolled inundation areas.

Impoverishment of the snail-fauna of the Great Hungarian Plain is proved by disappearence of species with a humidity requirement higher than that showed by present accidental elements. Thus from the fauna of Bátorliget since the observations of Soós (1915) disappeared *Acicula polita, Truncatellina claustralis* (in 1953 VÁGVÖLGYI yet found it!), *Ruthenica filograna,* and *Discus rotundatus.* Due to the four extinct species and *Pomatias elegans* found presently only as a sub-fossilium the recent fauna contains 73 species. Similarly, neither Discus rotundatus (published by CSIKI 1902) nor *Cepaea hortensis* in Püspökfürdő were found during author's two months expeditions in Rumania in 1970 and 1972. CZÓGLER (1917) found one year before the deforestation of the Makkos forest in Szeged living exemp lares of *Columella edantula, Cecilioides acicula, Bradybaena fruticum, Perforatella vicina, Perforatella bidens* and *Helicogona arbustorum.* Also living exemplares of *Perforatella vicina, Perforatella incarnata* and *Euomphalia strigella* were found in willow-groves in the environments of Szeged.

Many forests investigated by the author had been already lumbered. Constancy of biotopes of the 73 species regularly occurring at presenton one more places seems not to be satisfactorily assured due to intensive lumbering, frequentation (trampling) of nature conservation areas, general contamination of the environments and drainage.

References

AGÓCSY, P. (1965): Hazai csigafajaink elterjedését megszabó klímatényezők vizsgálata (Investigation of climatic factors determining distribution of snail species of Hungary). — Állattani Közlem. *52,* 21—27.

AGÓCSY, P. (1967): Soós LAJOS. (LAJOS Soós). — Biológiai Közlem. 39—41.

BÁBA, K. (1958): Die Mollusken des Inundationsraumes der Maros. — Acta Univ. Szeged *4,* 67—71.

BÁBA, K. and ANDÓ M. (1962a): Malaco-coenological Investigations Connected With Microclimatological Observations on the Shores of the rivers Tisza, Bodrog and Kraszna. — Acta Biol. Acad. Sci. Hung. *12,* 27.

BÁBA, K., KOLOSVÁRY, G., STERBETZ, I., VÁSÁRHELXI, J. and ZILAHI SEBESS, G. (1962b): Das Leben der Tisza XVII. Zoologische Ergebnisse der vierten Tiszaexpedition. Fortsetzung. II. Malakozönologische Untersuchungen. — Acta Biol. Szeged *8,* 207—211.

BÁBA, K. and ANDÓ, M. (1964): Mikroklíma vizsgálatokkal egybekötött malakocönológiai vizsgálatok ártéri kubikokban (Malaco-coenological investigations connected with microclimate investigations in holes on inundation area). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 97—110.

BÁBA, K. (1965): Malakocönológiai vizsgálatok a Tisza árterén (Malacocoenological investigations on the inundation area of the Tisza). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 93—98.

BÁBA, K. (1966): A Tisza hullámterének puhatestű Algyő és Szeged között (Molluscs of the flood-plain of the Tisza between Algyő and Szeged). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 91—98.

BÁBA, K. (1968): Néhány szárazföldi csigatársulás a Tisza völgyében (Some associations of snails in the Tisza valley). — Móra F. Múz. Évk. 269—282.

BÁBA, K. (1969a): Néhány Duna—Tisza közi homokpusztagyep és erdő malakocönológiai vizsgálata. A csigacönózisok szukcessziója (Malacocoenological investigation of some sand grasses and forests between the Danube and the Tisza. Succession of the snail-coenoses). — Szegedi Tanárk. Főisk. Tud. Közlem. *2,* 83—92.

BÁBA, K. (1969b): Die Malakozönologie einiger Moorwälder im Alföld. — Opusc. Zool. Budapest *9,* 71—76.

BÁBA, K. (1969c): Zönologische Untersuchungen der an der Flussbettkante der Tisza und ihrer Nebenflüsse lebenden Schnecken. — Tiscia (Szeged) *5,* 107—119.

BÁBA, K. (1970): Néhány Dél-Alföldi tölgyerdő csigatársulása (Snail coenoses of some oak-forests in the South Hungarian Plain).—Szegedi Tanárk. Főisk. Tud. Közlem. *2*, 95—100.

BÁBA, K. (1971): Elterjedési és ökológiai adatok a *Bradybaena fruticum* (O. F. Müller) hazai előfordulásának ismeretéhez (Distributional and ecological data concerning occurrence of Bradybaena fruticum (O. F. Müll.) (in Hungary). — Szegedi Tanárk. Főisk. Tud. Közlem. *2*, 89—98.

BÁBA, K. (1970—71a): Ökologische Beobachtungen bezüglich der Schneckenarten im Tisza-Tal. Die Besiedlung des Inundationaraums. — Móra F. Múz. Évk. 93—100.

BÁBA, K. (1970—71b): Malaconcenoses of backwaters of the Upper Tisza with various vegetations. — Tiscia (Szeged) *6*, 89—94.

BÁBA, K. (1972): The snail coenoses of the willow groves in the Middle Tisza region. — Tiscia (Szeged) *7*, 101—103.

BÁBA, K. (1973a): Szárazföldi puhatestű közösségek successiója magyarkőrises égerlápokban (Succession of terrestrial snail communities in Pannonian ash-alder marsch-forests). — Szegedi Tanárk. Főisk. Tud. Közlem. *2*, 43—50.

BÁBA, K. (1973b): Peopling of the inundation area of the Tisza by Mollusca. Regeneration of the snail populations in the area of river barrage Tisza II. — Tiscia (Szeged) *8*, 98—99.

BÁBA, K. (1973c): A víztelenedés hatása a mocsárerdők ls ligeterdők vízi puhatestűire (Effect of desiccation on water snails of marshy forests and gallery forests). — Soósiana *1*, 7—8.

BÁBA, K. (1974b): Javaslatok a magyarországi malakológiai kutatások összehangolására (Proposals to the co-ordination of malacological investigations in Hungary). — Soósiana *2*, 1—6.

BÁBA, K. (1974a): Különböző állapotú csévharaszti tölgyesek puhatestűinek mennyiségi viszonyai (QQuantitative relations of molluscs in oak-forests of different states in Csévharaszt). — Abstr. Bot. Budapest, *2*, 71—76.

BÁBA, K. (1975): Erdők állapotának minősítési lehetőségei a csigák mennyiségi változásai segítségével (Possibilities of forest qualification with the aid of quantitative changes of the snails). — Juhász Gy. Tanárk. Főisk. Tud. Közlem. *2*, 37—57.

BÁBA, K. (1977a): Die Kontinentalen Schneckenbestände der Eichen-Ulmen-Eschen Auwäldern (Fraxino pannonicae-Ulmetum pannonicum Soó) in der Ungarischen Tiefebene. — Malacologia *16*, 51—57.

BÁBA, K. (1977b): A csigák mennyiségi viszonyai a Crisicum ligeterdeiben (Quantitative relations of the snails in the groves of the Crisicum). — Békésmegyei Múz. Közlem. *6*, (in the press).

BÁBA, K. (1978): The Mollusca fauna of the Tisza, its research situation and tasks. — Tiscia, (Szeged) *13*, 197.

BÁBA, K. (1979): Die Succession der Schneckenzönosen in den Wäldern des Alföld und die Methoden zum Studium der Succession. — Malacologia *18*, 203—210.

BÁBA, K. (1981): Die Verbreitung der Landschnecken in ungarischen Teil des Alföld. — Acta Debrecina, Debrecen (in the press).

BOGNÁR, M. (1969): Malakocönológiai és ökológiai vizsgálatok a Duna árterén (Malacocoenological and ecological investigations on the inundation area of the Danube. — Thesis (Debrecen) 1—39.

CZÓGLER, K. (1935): Adatok a Szeged vidéki vizek puhatestű-faunájához (Data concerning the malacofauna of the waters around Szeged). — Szegedi Állami M. Kir. Baross G. Reálgimn. LXXXIV. Tanévi Ért. 1—25.

CZÓGLER, K. und ROTARIDES, M. (1938): Analyse einer vom Wasser angeschwemmten Molluskenfauna. Die Auswürfe der Maros und der Tisza bei Szeged. — A Magyar Biol. Kut. Munkái *10*, 8—44.

CSIKI, E. (1906): Mollusca in: Fauna Regni Hungariae K. M. Természettudományi Társulat, Budapest, 1—42.

DOMOKOS, T. (1979): A szikes tócsák világa; csigák, kagylók a szabadkígyósi pusztáról (World of the alkaline puddles; snails and valves from the puszta of Szabadkígyós). — Békésmegyei Term. véd. Évk. *3*, 41—64.

DUDINSZKY, E. (1907): Nagykálló környékén levő és volt mocsarak puhatestű állatai (Molluscs in the present and past marshes around Nagykálló). — Magyar Orvosok és Természetvizsgálók Vándorgyűlésének Munkálatai *34*, 235—237.

DUDICH, E. (1926): Faunisztikai jegyzetek. II (Faunistical notes. II) — Állattani Közlem. *23*, 87—96.

GEBHARDT, A. (1961a): A Mecsek-hegység déli síkjának Mollusca faunája (Mollusc fauna of the plain south of the Mecsek mountains). — A Janus Pann. Múz. Évk. 5—32.

GEBHARDT, A. (1961b): A Mohácsi-sziget és az Alsó-Duna árterének Mollusca faunája (Molluscfauna of the Mohács island and the Lower-Duna inundation area). — Állattani Közl. *48*, 1—4, 43—55.

HAZAY, J. (1881): Die Mollusken Fauna von Budapest. — Malakolog. Blätter 3—4.
HORVÁTH, A. (1950): A Szegedi Fehértó Mollusca faunája (The mollusc-fauna of the Fehértó of Szeged). — Annal. Biol. Univ. Szegediensis I., 321—325.
HORVÁTH, A. (1954): Az alföldi lápok puhatestűiről és az Alföld változásairól (About the molluscs of marshes of the plain and changes of the Hungarian Plain). — Állattani Közl. *44,* 1—2, 63—67.
HORVÁTH, A. (1955): Die Molluskenfauna der Theiss. — Acta Biol. Szegediensis, I., *1—4,* 174—185.
HORVÁTH, A., BERECK, P. und CSONGOR, GY. (1957): Das Leben der Tisza I. Über die Tierwelt der Tisza und ihrer Inundationsgebiete. — Acta Biol. Szeged. *3,* 94—97.
HORVÁTH, A. (1958): Die Malakologischen Ergebnisse der II. Tiszaexpedition. In: BERECK, P., CSONGOR, GY.: Das Leben der Tisza VII. Die Tierwelt der Tisza auf Grund neurerer Sammlungen und Beobachtungen. — Acta Biol. Szeged *4,* 216—218.
HORVÁTH, A. (1962): Kurzbericht über die Molluskenfauna der zwei Tisza-Expeditionen im Jahre 1958. — Opusc. Zool. Budapest, *4,* 77—83.
KERTÉSZ, M. (1890): Nagyváradnak és vidékének állatvilága (Fauna of Nagyvárad and its sourroundings). In: BUNYITAY V. (ed.) Nagyvárad természetrajza (Natural history of Nagyvárad). — Budapest, 135—244.
KERTÉSZ, M. (1901): Bihar megye állatvilága (Fauna of the county Bihar). — A Jászóvári prém. kanonokrend, Nagyváradi Főgymn. 1900—1901. évi Ért. Nagyvárad. 1—106.
KORMOS, T. (1904): Új adatok a Püspökfürdő élő csigáinak ismeretéhez (New data concerning the living snails of Püspökfürdő). — Állattani Közlem. *3.*
KOVÁCS, GY. (1974): Békéscsaba és környéke puhatestű faunája (The mollusc-fauna of Békéscsaba and its sourroundings). — Állattani Közlem. *61,* 35—42.
KOVÁCS, GY. (1979): A volt Dajka-kert recens puhatestű faunája (The mollusc fauna of the former Dajka-kert). — Múz. Híradó (Békéscsaba) *9,* 1—3.
KROLOPP, E. (1973): Dr. Soós LAJOS. (DR. LAJOS SOÓS). — Soósiana *1,* 4—6.
LÓCZY, L. (1886): Jelentés az 1885 nyarán a Maros-völgyben és Temes megye északi részében eszközölt földtani részletes felvételről (Report about the detailed geological survey performed in the summer of 1885 in the Maros-valley and in the northern part of county Temes). — Földt. Int. Évi. Jelent. 1885-ről, Budapest.
MOCSÁRY, S. (1868): Adatok Nagyvárad és vidéke puhányainak ismeretéhez (Data concerning the molluscs of Nagyvárad and its surroundings). — Természetrajzi Szemelv. (Nagyvárad) 108—119.
MOCSÁRY, S. (1872): Adatok Bihar megye faunájához (Data about the Fauna of county Bihar). — M. Tud. Akad. Mathem. és Term. tud. Közlem. *10,* 163—200.
PÉCSI, M. (1969): Magyarország tájföldrajza. A tiszai Alföld (Regional geography of Hungary. The Tisza Plain). — Budapest.
PINTÉR, J. (1962): Beiträge zur Verbreitung der Schneckengattung Cepaea in Ungarn. — Opusc. Zool.
PINTÉR, L. (1967): A Revision of the Genus *Carychium* O. F. MÜLLER 1977. in Hungary (Mollusca, Basommatophora). — Ann. Hist.-nat. Mus. Nat. Hung. *59,* 399—407.
PINTÉR, L. (1968): Revision der Ungarischen Arten der Gattung *Vitrea* FITZINGER 1833. (Gastropoda: Pulmonata). — Acta Zool. Acad. Sci. Hung. *14,* 175—184.
PINTÉR, L. (1970): Recent Zonitidae in Hungary. — J. Conch. *27,* 183—189.
PINTÉR, L. (1971): A magyarországi Daudbardiák (Mollusca) (The Daudbardias of Hungary). — Állattani Közlem. *58,* 1—4.
PINTÉR, L. (1973): Magyarország puhatestűinek kritikai jegyzéke (Critical list of the Hungarian molluscs). — Soósiana *1,* 11—17.
PINTÉR, L. (1974a): Katalog der rezenten Mollusken Ungarns. — Fol. Hist.-nat. Mus. Mat. *2,* 123—148.
PINTÉR, L. (1974b): Faunisztikai, nomenklatúrai és rendszertani megjegyzések (Feunistical, nomeclatural and systematical notes). — Soósiana *2,* 17—18.
PINTÉR, L. (1975): Die Oxychilini Ungarns (Gastropoda: Zonitidae). — Folia Hist.-nat. Mus. Matraensis *3,* 125—139.
PINTÉR, L., RICHNOVSZKY, A. and S. SZIGETHY A. (1979): A magyarországi recens puhatestűek elterjedése (Area of the recent molluscs of Hungary). — Soósiana (Suppl). *1,* 1—351.
PINTÉR, L., SZIGETHY, A. (1980): Die Verbreitung der rezenten mollusken Ungarns: Neunachweise und Berichtungen, II. — Soósiana *8,* 65—80.
RAPAICS, R. (1925): A Nyírség növényföldrajza (Plant geography of the Nyírség). — A Debreceni Tisza I. Tud. Társ. Honismertető Bizottságának Közlem. *1, 2,* 108—120.
RICHNOVSZKY, A., KOVÁCS, GY. (1962): The peat bog Mollusca fauna of Kecel—Császártöltés (County Bács-Kiskun in Hungary). — Opusc. Zool. Budapest *4,* 133—144.

RICHNOVSZKY. A. (1963): Baja és környékénak Mollusca faunája (The mollusc fauna of Baja and its surroundings).

RICHNOVSZKY, A. (1967): Data of mollusc fauna of the flood area of the Danube (Danubialia Hungarica, 42). — Opusc. Zool. Budapest *7,* 195—205.

RICHNOVSZKY, A. (1970): A magyarországi Duna-szakasz puhatestű faunájának ökológiai viszonyai (Ecology of the mollusc fauna of the Hungarian reach of the Danube.. — Állat tani Közlem. *57,* 125—130.

RICHNOVSZKY, A. (1973): A magyarországi Duna-szakasz Mollusca faunájának ökológiája és rendszertana (Ecology and systematics of the mollusc fauna of the Hungarian reach of the Danube). — Thesis for obtaining the grade candidatus.

ROTARIDES, M. (1926a): Adatok az Alföld puhatestű faunájának ökológiájához (Data concerning ecology of the mollusc fauna of the Hungarian Plain). — Állattani Közl. *23,* 179—226.

ROTARIDES, M. (1926b): Über die Bändervariationen von Cepaea vindobonensis. — Fer. Zool. Anz., *67,* 28—44.

ROTARIDES, M. (1926c): Az örvös csiga *(Cepaea vindobonensis* (C. PFR.) szalagvariációja*)* (Variance of the bands of *Cepaea vindobonensis* (C. PFR.). — Állattani Közlem. *23,* 76—86.

ROTARIDES, M. (1927): Szeged és közvetlen környékének Mollusca (puhatestű) faunájáról (About the mollusc fauna of Szeged and its immediate surroundings). — Acta Litt. ac Sc. Univ. Hung. Franc. Jos. Sectio Sc. Nat. 177—213.

ROTARIDES, M. (1928): Apróbb állattani megfigyelések. I. Passzíve terjedő fajok — behurcolt fajok. II. Csigakannibálok. III. A tüdős csigák csillótakarójának kérdéséhez (Smaller zoological notes. I. Passively transported — imported species II.. Cannibal snails. III. About the problem the cilia-cover of pulmonate snails). — Állattani Közlem. *25,* 48—53.

ROTARIDES, M. (1931): A lösz csigafaunája, összevetve a mai faunával, különös tekintettel a Szeged vidéki löszökre (Snail fauna of the loess, compared with the recent fauna with special regard to the loesses of Szeged). — A Szegedi Alföldkut. Biz. Könyvt. Vi. Szakoszt. Állattani Közl. Szeged *8,* 178.

ROTARIDES, M. (1932): Über die pleistozäne Molluskenfauna von Szeged und Umgebung (Ungarn). — Arch. Molluskenk. *64,* 73—102.

ROTARIDES, M. (1933): Magyarország Mollusca-faunájának rendszeres felsorolása (Systematic list of the Hungarian mollusc fauna). — A Magyar Biol. Kutatóint. Munk. *7,* 148—163.

ROTARIDES, M. (1941): Biotopképek jelentősége (Importance of biotope-pictures). — Állattani Közlem. *38,* 158—163.

SOÓS, L. (1915): A Nagy Magyar Alföld Mollusca faunájáról (About the mollusc fauna of the Great Hungarian Plain). — Állattani Közlem. *14,* 147—173.

SOÓS, L. (1926): A magyar Mollusca-fauna múltja (The past of the Hungarian Mollusc fauna). — Ann. Mus. Nat. Hung. *24,* 392—421.

SOÓS, L. (1927): Néhány faunisztikai és ökológiai adat (Some faunistic and ecologic data). — Állattani Közl. *24,* 183—185.

SOÓS, L. (1928): A bátorligeti ősláp Mollusca faunája és az Alföld múltjának kérdése (The mollusc fauna of the primordial swamp pf Bátorliget and the problem of the past of Hungarian Plain). — Állattani Közl. *25,* 103—113.

SOÓS, L. (1934): Magyarország állatföldrajzi felosztása (Zoogeographical distribution of Hungary). — Állattani Közl. *31,* 1—25.

SOÓS, L. (1943): A Kárpát-medence Mollusca-faunája (The mollusc fauna of the Carpatian basin). — Budapest, 1—478.

SOÓS, L. (1956): Csigák I—II. (Gastropoda I—II.). Fauna Hungarica. — Vol. 19, 2 Akadémiai Kiadó, Budapest.

SZIGETHY, A. (1973): A Vertigo O. F. Müller 1774 genus magyarországi fajai (Mollusca, Gastropoda) (Species of the genus Vertigo O. F. Müller 1774, living in Hungary). — Soósiana *1,* 19—31.

SZIGETHY, A. (1975): Az Endodontidae család magyarországi fajai (Die Arten in Ungarn aus der Familie Endodontidae). — Soósiana, *3,* 15—26.

SZENTIVÁNYI, J. (1944—45): Tervezet az Alföld állatvilágának kutatására (A project for the investigation of the animals of the Hungarian Plain). — Alföldi Tudományos Intézet Évkönyve, 1—7.

TÓTH, M. (DÉVAI, J., DÉVAI, GY., SZABÓ, K., HORVÁTH, J., BANOSI, J.) (1971—1972—1973): Angaben zur Kenntnis der hydrobiologischen Verhältnisse der Toten Fluss-Armen deria Bodrog bei Sárospatak I. Wasserschemie. II. Flora und Fauna. — Acta Biol. Debrecin *9,* 177—186; *10—11,* 117—127.

TREITZ, P. (1909): Jelentés az 1907. évi Nagy-Alföldi agrogeológiai felvételeiről (Report on the agrogeological survey of the Great Hungarian Plain in 1907). — Földtani Int. Évi Jelent. 1907-ről, Budapest.

TRAXLER, L. (1894): A Munkács környékén élő házas csigák és kagylók rendszeres jegyzéke (Enumeratio supplem. Molluscarum testaceorum faunae Munkacsiensis). — Természetrajzi Füz. *17*, 83—92.
TÖMÖSVÁRY, Ö. (1886): Délmagyarország állattani tekintetben (South-Hungary in respect of zoologx). — DR. BRENER ÁRMIN Helyrajzi Emlékmű a Magyar Orvosok és Természetvizsgálók Buzias Temesvárott megtartott XXIII. Vándorgyalésére. Temesvár, 124—165.
B. TÓTH, M., ARADI, CS., DÉVAI GY., FINTHA, J., HORVÁTH, K., BANCSI, J., ÖTVÖS, J. (1975): Tanulmányok Haláp élővilágáról. Puhatestűek (Studies on the living world of Haláp. Mollusca). — Debreceni Déri Múz. Évk. (Debrecen) 13—156.
VARGA, A., PINTÉR, L. (1972): Zur Problematik der Gattung Hygromia Risso 1826. — Fol. Hist.-nat. Mus. Matr. *1*, 121—129.
VARGA, A. (1979): VÁSÁRHELYI ISTVÁN gyűjteménye a Herman Ottó Múzeumban. I (Mollusca-Puhatestűek) (The collection of ISTVÁN VÁSÁRHELYI in the Ottó Herman Museum I. Molluscs). (In the press.)
VÁGVÖLGYI, J. (1953): Bátorliget puhatestű-faunája. Mollusca (Mollusca fauna of Bátorliget). — In SZÉKESSY, V. (ed.) The living world of Bátorliget. Budapest.
VÁGVÖLGYI, J. (1954): A Kárpátok malakofaunájának kialakulása (Development of the mollusc fauna of the Carpates).
VÁSÁRHELYI, I. (1958): Beiträge zur Schnecken-Fauna der Tisza. — In BERETZK, P. and CSONGOR, GY. (eds.) Das Leben der Tisza. VII. Die Tierwelt der Tisza auf Grund neuerer Sammlungen und Beobachtungen. — Acta Biol. Szeged *4*, 218—222.
WAGNER, J. (1933): Egy új *Helicella*-faj Magyarország faunájában (A new *Helicella* species in the Hungarian fauna). — Állattani Közlem. *30*.
WAGNER, J. (1935a): Helicella spirula Ceglédről (*Helicella spirula* in Cegléd). — Állattani Közlem. *32*.
WAGNER, J. (1935b): *Helicella* (Helicelle) *spirula* WESTL. aus Ungarn. — Arch. für Molluskenkunde *67*.
WAGNER, J. (1935c): Faunánk egy új *Helicella* fajáról (About a new Helicella specirs in Hungary). — Állattani Közlem. *32*.
WAGNER, J. (1938): Die Verbreitung der Gattung *Pomatias* in Ungarn einst und jetzt, mit Bemerkungen über das rezente Verkommen das neuentdeckten *Pomatias costulatum* RM. und das *Pomatias elegans* MÜLL. — Basteria *3*.
WESTERLUND, C. A. (1886—1890): Fauna der in der paläarktischen Region lebenden Binnenconchylien II—VII., 1—2, Lund-Berlin.

Az Alföldi szárazföldi csigái kutatásának története és mai helyzete II.

BÁBA K.

Juhász Gyula Tanárképző Főiskola, Szeged

Kivonat

A szerző a kultúrhelyeken előforduló, kipusztult, az ártereken véletlenszerűen megjelenő, továbbá az országhatáron kívül előforduló és bizonytalan irodalmi adatokat kirekesztve 73 fajra szűkíti a Magyar Alföld szárazföldi csigafaunáját. Az elemzést 19.356 egyeden végezte.

Az elemzésnek három fő szempontot választott. 1. A zonális és azonális térszínek növénytársulásaiban egyedszám és előfordulási gyakoriságuk (ezen belül egy vagy több ponton fordul elő állandóan vagy ideiglenesen) 2. Folyóvizek faunatranszportáló tevékenysége és az erdőközi terjedés hogy játszik közre a megtelepedésben. 3. Fajok környezetigénye.

Az országhatáron kívül eső területeken élő fajok elhagyásával a fajlistának az első közleményben nem szereplő Cochlicopa nitenssel való kiegészítése után 91 faj alkotja az Alföld faunáját.

Kihaltak az Alföldről a Pomatias elegans, Acicula polita, Truncatellina claustralis, Ruthenica filograna, Discus rotundatus. Kultúra követők az Oxychilus hydatinus, Milax budapestiensis. Ezek szabad természetben nem fordulnak elő.

Az irodalmi adatok és a hordalékfauna csökkenése alapján megállapítható volt, hogy a fauna a század eleje óta változott — szegényedett. Ennek okául a lecsapolások, erdőirtások, folyamszabályozás, és más kultúrhatások adhatók meg.

Az Alföld mint tájegység faunájáról adható kép tehát nem statikus, hanem éppen a folyók élő egyedeket szállító tevékenysége, továbbá az állandóan ható kultúrhatások révén dinamikus.

Istorijat instraživanja puževa Panonska nizije i stanje danas II.

BÁBA K.

VPŠ Juhász Gyula , Szeged, Hungaria

Abstrakt

Autor prikazuje 73 vrste suvozemnih puževa Panonske nizije sa sa kulturnih staništa, slučajne nalaze na plavnim područjima, izumrle predstavnike, zanemarujući nedovoljno precizne podatke van državnih granica. Analiza je izvršena na 19 356 jedinki.

Analiza je vršena sa tri osnovna stanovišta:

1. Broj i frekvencija pojavljivanja u biljnim zajednicama zonalnih i azonalnih staništa (unutar kojih je vrsta stalno ili privremeno prisutna na jednom ili više mesta),
2. Uloga tekućih voda na raseljavanje i proces naseljavanja unutar šume i
3. Ekološki zahtevi vrsta.

Zanemarujući vrste van državnih granica i dopunom faunističke liste prvog saopštenja vrstom Cochlicopa nitens u fauni Panonske nizije se javlje 91 vrsta suvozemnih puževa.

Nestale su u Panonskoj niziji vrste Potamias elegans, Acicula polita, Truncatellina claustralis, Ruthenica filograna, Discus rotundatus. Vrste Oxychilus hydatinus i Milax budapestiensis nalaze se u kulturama i ne javljaju se u slobodnoj prirodi.

Na osnovu literaturnih podataka i smanjivanja predstavnika faune u nanosima konstatovana je promena faune od početka XX veka. Uzroke osiromašenja treba tražiti u melioracionim zahvatima, regulaciji reka, seči šuma i u drugim antropogenim utucajima.

Fauna područja Panonske nizije nije statična, već je usled raseljavanja živih jedinki rekama i usled stalnij antopogenih dejstava dinamična.

ИСТОРИЯ ИЗУЧЕНИЯ НАЗЕМНЫХ МОЛЛЮСКОВ И ИХ СОВРЕМЕННОЕ ПОЛОЖЕНИЕ НА ВЕНГЕРСКОЙ РАВНИНЕ II.

К. Баба

Пединститут им. Дюла Юхас, Сегед

Резюме

Изучая наземных моллюсков Венгерской Равнины, живущих на культивируемых угодьях случайно появившихся на заливных территориях, вымерших, дальше встречающихся за государственной границей, автор насчитывает их до 73 видов. Анализ этих видов проведен на 19,356 экземплярах.

При анализе поставили три главных вопроса:

1. Их одиночная или массовая встречаемость в зональных и азональных растительных сообществах. (Одиночная или массовая их встречаемость; постоянная или временная).
2. Способность протекающих протекающих рек в транспортировке фауны и роль лесных ценозов в их приеме.
3. Требовательность видов к окружающей среде.

Список фауны наземных моллюсков на Венгерской Равнине, не считая видов проживающих на заграничных территориях (кроме *Choclicopa nitens* не приведенного в первой публикации) — составляют 91 вид. В настоящем сообщении (1 таблицы) приводится список видов-живущих только в рамках государства. Вымершими являются на Венгерской Равнине *Pomatias elegans, Acicula polita, Truncatellina claustralis, Ruthenica filograns, Discus rotundatus.* Последователами культуры являются *Oxychilus hydatinus, Milax budapestiensis.* Свободно не появляются в природе.

На основании литературных данных, а также результатов исследований определили, что фауна с начала современного столетия в значителбной степени изменилась — обеднела. К этому привели мелиоративные мероприятия, вырубка лесов, регуляция рек и другие мероприятия.

Венгерская Равнина, как ландшафтная единица с фаунистической строны, не является статистической, под влиянием ресного транспорта и под влиянием культурной деятельности человека, показывает определенную динамику.

Tiscia (Szeged) Vol. XVIII, pp. 97—102 (1983)

EFFECT OF THE REGIONS OF THE TISZA VALLEY ON THE MALACO-FAUNA

K. BÁBA

Department of Biology, Gyula Juhász Teachers' Training College, Szeged
(Received September 1, 1981)

Summary

Author, based on earlier investigations, establishes correlations between the snail-fauna of the vegetation of the river bank succession and the water basins. 1. The rivers has a role in the development of the snail-fauna transporting living individuals from their water basins (BÁBA 1979 b.). 2. On the basis of mathematical evaluation of different groups established on humuditiy demands it can be proved that the snail-fauna of the plain can be differentiated according to the flora grouping (BÁBA 1979a). 3. New zoogeographical grouping of the terrestrial species made it possible to make a mathemathical-distributional investigation of the river bank faunas and to interprete the results on the basis of the data about stream densities established by ANDÓ (1972) (Figs. 1. and 2).

On the graph of Figure 2. the regions of the Great Hungarian Plain are divided into three parts; no identity is shown between the Dráva Plain and the Danube Plain and between these and the regions of the Tisza Plain.

Between the smaller regions of the Tisza Plain correlation was established on a significancy level of 10 per cent (this value was used for balancing fauna-deformations due to civilizational effects). From the composition of the regions on the left side and on the right side of the Tisza emerges that the rivers rising from the Northern Carpathians (mountains poor in endemisms, Soós 1943) give no individuality to the regions they travers. The Körös—Maros region has an other fauna. This is in accordance with the facts published by ANDÓ (1972): the leftside tributaries of the Tisza rise from two separate water basins characterized by different hydrographical and hydrodynamical properties. This could be proved by zoogeographical statistical analysis.

It can be established that the terrestrial snail-fauna of the physical-geographical regions of the Great Hungarian Plain is influenced by climate, forest thickness, soil factors and by differences of water basins of the rivers and inside this water quantity and stream density of the regions. The actual fauna is determined by these factors.

Introduction

Analysing the fauna in the deposits of the river Tisza and its tributaries (BÁBA 1979b) and even more so investigating the effect of the climate types discernible on the Great Hungarian Plain (KAKAS 1960) it was established that stocking of the different regions with snails depends on the rivers which come from different directions from the mountains (BÁBA 1979a).

Apart from the biotic and climatic factors which manifest themselves through the soils and apart from the abiotic orographic factors the effects of the rivers must be considered when the snail-fauna of the Great Hungarian Plain and inside this the Tisza Plain (PÉCSI 1969) is analysed.

Methods

Snails collected from different plant associations were grouped according to the physical-geographic regions established by SOMOGYI (1961). In the different regions only the snails of the vegetation of the mineralogeneous successions were considered because only these are directly connected with the rivers. These plant associations are the willow groves, willowpoplar groves, elm-oak-ash groves and hornbeak-oak groves (*Salicetum triandrae* MALCUIT, *Salicetum albae-fragilis* ISSLER, FRAXINO P.—ULMETUM PANNONICUM SOÓ, *Querco roboris — Carpinetum hungaricum* SOÓ) (SOÓ 1964). It is to be noted that the occurrence of these associations is very variable along the different rivers, especially in the regions Jászság, Sajó-Hernád-köz (other name: inundation areas of Heves and Borsod), Taktaköz, and Hortobágy are poor in these associations due to intensive agriculture and forestry (cultural influences).

The effect of rivers manifest itself in number of species and individuals, in quality of species and in frequency of species. Differences in the snail-fauna between the different regions were established by three ways. Differences in species composition of the regions were investigated to establish wether from the different river basins different species are coming and wether in the number and in the frequency of species differences could be observed (BÁBA 1981a, 1981b). It was also investigated wether there is identity between the fauna-composition of the Duna—Tisza Plain and the Dráva Plain Latter problem was investigated with mathematical methods. Zoogeographically the observed snail species can be ordered into 10 fauna-groups. Considering also the sub-groups 18 units can be distinguished (distribution according to BÁBA 1980). Empirical frequency distribution test with more than two classes and χ^2-test were applied in comparing distribution of fauna-groups in the regions. Altogether 13 physico-geographical regions were investigated: 1. Dráva Plain, 2. Danube Plain, 3. Danube—Tisza Plain, 4. Lower reach of Tisza, 5. Middle-Tisza reach, 6. Hortobágy, 7. Sajó—Hernád-köz, 8. Taktaköz, 9. Körös region, 10. Körös—Maros region, 11. Nyírség, 12. Szatmár—Bereg Plain including Bodrogköz (=Northern Plain), 13. Temesköz (Rumania).

Fig. 1. Comparison with more than two classes (x^2 test) of frequency distribution between the zoogeographical categories of the regions of the Great Hungarian Plain

	1	2	3	4	5	6	7	8	9	10	11	12	13
01	5	14	14	6	7	10	4	3	12	6	12	19	20
02	0	0	1	0	0	1	0	0	1	1	0	0	1
03	2	1	2	1	0	0	2	0	1	2	2	3	2
041	1	1	0	0	0	0	0	0	0	0	0	0	0
042	1	1	1	1	0	1	2	0	0	1	1	2	2
043	1	0	2	1	0	1	1	0	0	1	1	3	2
044	3	3	0	0	0	0	1	0	0	1	1	1	4
05	2	2	2	0	0	0	0	0	0	2	0	1	4
06	2	1	0	0	0	0	0	0	0	1	1	1	1
07	5	1	4	1	1	1	0	0	1	1	4	6	9
081	0	0	0	0	0	0	0	0	0	0	0	0	1
082	0	0	0	0	0	0	1	0	0	0	0	1	1
083	1	0	0	0	0	0	0	0	0	0	0	1	1
084	0	0	1	0	0	0	0	0	0	0	0	0	0
085	0	0	0	0	0	0	1	0	0	2	1	0	2
09	1	1	0	0	0	0	0	0	0	0	0	0	0
010	0	1	0	0	0	0	0	0	0	0	0	0	0
Σ =	24	26	27	10	8	14	12	3	15	18	23	38	50

Differences of the regions

Investigation of the differences of the regions based on their snail-fauna is possible because definite differences could be established in the species composition and in the quantitative aspect of the sediment-faunas (BÁBA 1979b). Analysing the sediment-faunas it can be established that these faunas can be differentiated by their qualitative and quantitative composition due to differences in the macro-climate and micro-climate of their water basins.

The rivers transport not only dead but also living individuals. The greater the rise and fall and the quantity of the water the more is the number of species and the number of individuals which are transported.

Qualitatively the Northern Plain differs in four species *Hygromia trassylvanica* (WEST.), *Perforatella dibotrion* (M. KIM.), *Lehmania marginata* (O.F.M.), *Helicogona banatica* (RM.) (differential species as compared with Nyírség). In the Nyírség the 6 differential species are partly accidental as *Bielzia coerulans* (M. BIELZ), partly extinct *Acicula polita* (HARTM.), *Discus rotundatus* (O.F.M.), *Ruthenica filograna* (RM.) (Soós 1915) and *Truncatellina claustralis* (GREDL.) still has been found (VÁGVÖLGYI 1953) and the rediscovered *Pomatias rivulare* (EICHW.). Common species of the two regions are *Clausilis pumila* C. PFEIFF, *Perforatella vicina* (RM.) and *Helix lutescens* RM. On the inundation area of Sajó—Heves occur two species characteristic to the Eastern-Carpates and to the dacic-podolic regions respectively: Perforatella vicina and *Hygromia transsylvanica*. On the Kőrös-region only *Helix lutescens* and *Oxychilus hydatinus* (RM.), on the Körös—Maros region *Hygromia kovacsi* PINTÉR et VARGA, on the Rumianian parts *Helicogona banatica* and *Deroceras reticulatum* (O.F.M.), on the Danube—Tisza region at the border of the Gödöllő hill-country *Deroceras reticulatum* and *Ena obscura* (O.F.M.), on the Hortobágy the recently found "accidental" element *Laciniaria plicata* (DRAP.) (PINTÉR and SZIGETHY 1980) are the differential elements as contrasted to the other regions. On the Dráva Plain and the Duna Plain live three species characteristic also to the alpine water basin: *Aegopinella ressmanni* (WEST.), *Helicogona arbustorum* (L.), and *Cepaea nemoralis* (L.). In contrast to this live only on the Danube Plain (inundation area of the Danube and on the plain of Solt) as accidental elements *Aegopinella pura* (ALD.) and *Trichia unidentata* (DRAP.). The differential elements of Dráva Plain and Danube Plain are only locally settled as *Daudebardia rufa* (DRAP.), *Perforatella bidentata* (GM.), *Helicogona planospira* (LAM.), and *Cepaea hortensis* (O.F.M.).

This differences between the regions are much more expressed when quantitative differences are considered. Species collected with the aid od the square method are valuated by a 1—5 scale (1—60=1; 61—120=2; 121—180=3; 181—240=4; 241— =5). As an example 18 frequent species are given:

Numbers in the head-piece mean: 1. Dráva Plain, 2. Danube Plain, 3. Danube—Tisza region, 4. Trans-Tisza region: Sajó—Hernád region, Taktaköz, Hortobágy, Körös region, Körös—Maros region, Lower Tisza, Temesköz, 5. Nyírség (until Szatmár in Rumania), 6. Bodrogköz with the Szatmár—Bereg plain.

On the basis of quantity of occurrence the regions can be well separated. In the different regions different species are predominant. In the case of common species they occur in different frequencies. Based on this, the 13 middle and small regions (according to SOMOGYI 1961) can be reduced to 6 higher units (BÁBA 1979a, see Table). These 6 higher units correspond to the flora groups of Soó (1964): Titelicum, Colocense, Praematrium, Crisicum, Nyírségense, Samicum. This is caused not only by the differences in climate and forest types but also by the differences in the density of streams.

Density of streams is 0.1—0.2 km km^{-2} on the Danube—Tisza Plain, nn the Lower-Tisza Plain, and on the greater part of Crisicum (the immediate vicinity of Körös excluded). *Helicella obvia* and *Cepaea vindobonensis* living on dryer places has a frequency value parallel with the lower density of streams. Nyírség and the Northern Plain has a stream density of 0.3—0.5 km km^{-2} (ANDÓ 1972).

Comparison of the regions gets an other meaning when they are compared on the basis of the distribution frequency of zoogeographical categories in the plant associations occuring on the river banks, on places directly influenced by the rivers. This grouping, taking into consideration the transport by the rivers, shows more expressed the differences of the snail-fauna remaining and settling down on the inundation areas due to the different water basins (Fig. 1. and 2).

P= 13		12	11	10	9	8	7	6	5	4	3	2	1
1	70	50	50	70	10	70	50	30	30	70	30	50	
2	70	50	70	70	70	99	50	70	90	70	50		
3	90	90	70	70	70	95	30	90	90	95			
4	97,5	99	95	90	70	90	70	90	70				
5	90	90	90	50	90	70	30	90					
6	90	90	70	50	70	90	30						
7	70	50	50	90	30	70							
8	99	97,5	95	90	90								
9	70	70	70	50									
10	90	50 -	70										
11	95	95											
12	90												
13													

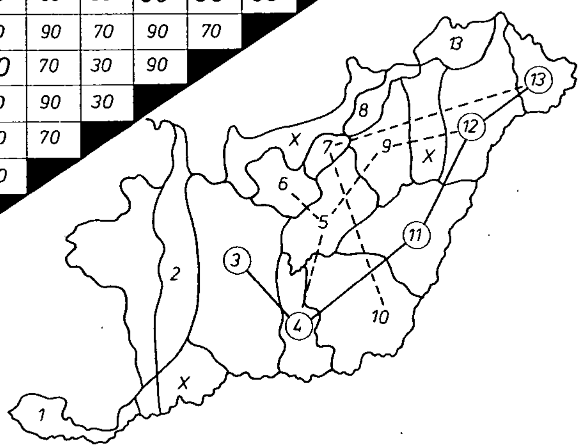


Fig. 2.
Result of chi^2 probes, significancy level: P=, and the graf of significant in each area similarities

On the map of Figure 2. the results are represented with the aid of a graph. Choosing a 10 per cent significancy level to balance deformations due to cultural effects, the Great Hungarian Plain can be divised into three parts: the Dráva Plain and the Danube Plain showing no identity with each other nor with the regions of the Tisza Plain (PÉCSI 1969). In contrast to this the smaller regions of the Tisza Plain show, however, only a low affinity between themselves characterized by 5—10 per cent. On the basis of these affinities two interesting facts can be considered.

First, the regions on the right bank of the Tisza show connections with the left bank regions. This means that the snail-fauna of these inundation areas are only slightly influenced by the rivers with low water quantity as the Hernád, Sajó, and Zagyva. The cause of this is that the Northern Carpates are poor in endemism (SOÓS 1943) and so individuality of these regions could notte developed.

On the other hand, the Körös—Maros region (including Temesköz) is separated from the faunas of the other left side tributaries. This can be interpreted by data published by ANDÓ (1972). He distinguishes two water basins for the left side tributaries: North-Eastern water basin (Upper-Tisza, Szamos, Kraszna, Túr, Batár, Visa, Iza, Sebes-Körös and Fekete-Körös. This water basin has a stream densitiy of 0.3—0.5 km km^{-2} and is characterized by great differences in rise and fall.) The other is the South-Eastern water basin of the rivers Kis and Nagy-Szamos, Fehér-Körös, Maros, Aranyos and the Küküllő-s with 0.5—0.6 km km^{-2} stream density but with a more steadily flow.

References

ANDÓ, M. and VÁGÁS, I. (1972): A Tisza-völgy 1970. évi nagy árvize (The great flood of 1970 in the Tisza-valley). — Földr. Közlem. *1*, 18—37.

BÁBA, K. (1979a): A csigák mennyiségi viszonyainak és a klímának a kapcsolata (Connections between quantitative relations of snails and climate). Fourth Meeting of Hungarian Malacologists in Gyöngyös. — Heves Megyei Tanács Nyomdája, 5—6.

BÁBA, K. (1979b): Die Succession der Schneckenzönosen in den Wäldern des Alföld und die Methoden zum Studium der Succession. — Malakológia *18*, 203—210.

BÁBA, K. (1980): Eine neue zoogeographische Gruppierung der Ungarischen Landmollusken und die Wertung des Faunabildes. — Haliotis *10*, 15.

BÁBA, K. (1981a): History of the investigation of the terrestrial snails of the Hungarian Plain and its present situation. II. — Tiscia (Szeged) (in the press).

BÁBA, K. (1981b): Die Verbreitung der Landschnecken in ungarischen Teil des Alföld. — Acta Debrecina, Debrecen (in the press).

GEBHARDT, A. (1961a): A Mecsek-hegység déli síkjának Mollusca faunája (The Mollusca fauna of the plain south of the Mecsek mountains). — A Janus Pann. Múz. Évk. 5—32.

GEBHARDT, A. (1961b): A Mohácsi-sziget és az Alsó-Duna árterének Mollusca faunája (The Mollusca fauna of the Mohács island and of the inundation area of the Lower Danube in Hungary). — Állattani Közlem. *48*, 43—55.

KAKAS, J. (1960): Természetes kritériumok alapján kijelölhető éghajlati körzetek Magyarországon (Climate regions on the basis of natural criteria in Hungary). — Időjárás *64*, 328—339.

PÉCSI, M. (1969): A Tiszai-Alföld (The Tisza-Plain). — Budapest.

PINTÉR, L. I., RICHNOVSZKY, A. and SZIGETHY, A. (1979): Magyarországi recens puhatestűek elterjedése (Recent occurrence of molluscs in Hungary). — Soósiana (Suppl). *1*, 1—351.

PINTÉR, I., SZIGETHY, A. (1980): Die Verbreitung der rezenten Mollusken Ungarns: Neunachweise und Berichtigungen. II. — Soósiana *8*, 65—80.

SOÓ, R. (1964): A magyar flóra és vegetáció rendszertani-növényföldrajzi kézikönyve. I (Synopsis systematico-geobotanica florae vegetationisque Hungariae. I). — Budapest.

SOÓS, L. (1915): A Nagy-Alföld Mollusca faunájáról (About the Mollusca fauna of the Great Hungarian Plain). — Állattani Közlem. *14*, 147—173.

SOÓS, L. (1943): A Kárpát-medence Mollusca-faunája (The Mollusca fauna of the Carpathian basin). — Budapest.

SVÁB, J. (1973): Biometriai módszerek a kutatásban (Biometrical methods in the research). — Budapest.

VÁGVÖLGYI, J. (1953): Bátorliget puhatestű faunája. (Mollusca fauna of Bátorliget). — In SZÉKESSY, V. (ed.) Bátorliget élővilága (The living organisms in Bátorliget).

A Tiszavölgy tájegységeinek hatása a malakofauna kialakulására

BÁBA K.

Juhász Gy. Tanárképző Főiskola Biológiai Tanszék, Szeged, Magyarország

Kivonat

A szerző korábbi vizsgálatainak alapján kapcsolatot mutat ki a folyók vízparti, növényzeti successió sorában található erdők csigái és a vízgyűjtőterületek közt. A korábbiakban vizsgált összefüggések alapján. 1. A folyók szerepet játszanak vízgyűjtőikből élő egyedek transzportálásával, a csigafauna kialakításában (BÁBA 1979b). 2. A fajok abundancia viszonyainak nedvességcsoportok szerinti összehasonlító matematikai vizsgálatával igazolható, hogy a csigafauna az Alföldön a növényzeti flórajárásoknak megfelelően elkülönül (BÁBA 1979a). 3. A magyarországi

szárazföldi fajok új állatföldrajzi besorolása lehetőséget adott arra, hogy a folyók vízparti faunáját tájegységek szerint matematikai eloszlásvizsgálattal összevesse s az eredményeket (1.2. ábra Andó 1972 1972 vízfolyássűrűség adatai alapján értelmezze.

E szerint a folyók vízgyűjtők szerint csigafaunájuk alapján elkülönülnek a Tisza jobb és balparti folyóinak különböző vízrajzi és vízjárási tulajdonságai (Andó 1972) A csiga fauna állatföldrajzi és vízjárási megoszlásában is különbséget mutatnak a statisztikai elemzés alapján.

Uticaj deonica doline reke Tise na razvoj malakofaune

Bába K.

VP Juhász Gyula Katedra za biologiju, Szeged, Hungaria

Abstrakt

Autor na osnovu svojih ranijih istraživanja ukazuje na povezanost izmedju slivnog područja reke i faune puževa u šumama u nizu vegetacijske sukcesije priobalne zone:

1. Reke učestvuju u razvoju faune puževa transportuju i žive primerke sa slivnog područja (Bába, 1979b).

2. Na osnovu uporedno matematičke analize abundantnosti vrsta prema vlažnosti potvrdjuje se, da se fauna puževa Panonske nizije, adekvatno florističkim elementima, razdvaja (Bába 1979a).

3. Novo zoogeografsko razvrstavanje puževa Madjarske omogućio je, da se fauna priobalnih zona po rejonima uporedi matematičkom obradom i da se dobijeni rezultati tumače prema Andó-u 1972 (sl. 1.2).

ВЛИЯНИЕ ПРИРОДНОГО КОМПЛЕКСА ДОЛИНЫ РЕКИ ТИСЫ НА ОБРАЗОВАНИЕ МОЧОКОФАУНЫ

К. Баба

Педагогический институт им. Дюла Юхас, кафедра биологии, Сегед, ВНР

Резюме

На основании предыдущих исследований автор показывает на взаимные связи между моллюсками, живущими по берегам рек, а в сукцессивной части лесной растительности речных бассейнов. На основании совокупных исследований заключил:

1. Реки играют значительную роль в образовании фауны моллюсков посредством их индивидуального транспорта в бассейне реки (Баба 1979 б).

2. Посредством отношений абунданаций виды сравниваются по группам влажности, оправдывая их математическими исчислениями, что фауна моллюсков на Венгерской Равнине отделяется согласно флорических районов растительности (Баба 1979а).

3. Занесение венгерских наземный видов в новое зоогеографическое деление дает возможность новой оценки фауны берегов рек отдельных ландшафтов и с помощью математических исчислений сопоставите их результаты на основании обьяснения Андо 1972, касающиеся густоты воды.

Ландшафты Великой Венгерской равнины разделяются на 3 части. Равнины Дравы, Дуная и Тисы, которые между собой не являются идентичными. Отдельные, меньшие хандшафты равнины реки Тисы под влиянием культурной деятельности человека стали идентичными. Право и левобережные ландшафты р. Тисы во взаимных отношениях показывают на то, что нистекающие реки с маловодных Северных Карпат не образуют своеобразные характерные ландшафты на тех местах, по которым они протекают. (В эндемах очень бедная горная страна, Шоо, 1943)

В то же время фауна между р. Кереш и Марон имеет совершенно другое сложение. Это определялось путем анализа зоогеографической статистики.

Установлено, что на развитие фауны моллюсков в природогеографических ландшафтах Венгерской равнины (Алфелда) влияют кроме климатических, культиваций леса и почвенных условий, также разницы в водосборных территориях протекающих рек, их канохы и отношения густоты водной сети отдельных ландшафтов.

Tiscia (Szeged) Vol. XVIII, pp. 103—112 (1983)

GROWTH OF PIKE (ESOX LUCIUS L.) IN THE SECTION OF THE TISZA RIVER AT TISZAFÜRED

Á. HARKA

Kossuth Lajos Secondary School, Tiszafüred
(Received January 25, 1981)

Abstract

On the basis of measurements on 204 fish specimens the following relationship was established between the standard body length and body weight of pike:

$$\lg W = -4.811 + 2.930 \lg L_c,$$

where W = body weight in g, L_c = body length in mm.

The following relation was found between standard body length and total body length:

$$L_t = 5.651 + 1.110\, L_c$$

The determination of the age of pike as well as its body length in the single years was performed on the basis of the growth-rings of scales. Growth can be well described by Bertalanffy's equation:

$$l_t = 1008.6[1 - e^{-01695(t+075)}]_x,$$

where l_t = standard body length of pike at the age of "t", e = the base of natural logarithm.

Introduction

Pike has been a very important fish species especially in the tributaries and stagnant waters of the Tisza, and with the establishing of reservoirs it has become increasingly frequent also in the main branch of the river. Therefore it may be important from economical aspect to obtain knowledge about its growth which has not been studied to date Hungarian waters.

This paper reports on growth studies performed on behalf of the Fisheries Research Institute, Szarvas in the section of the Tisza in the water storage area of Kisköre, and presents at the same time the first information in connection with the growth of pike in Hungary.

Materials and Methods

In the examinations, data of 204 fish specimens collected from 1. 3. 1977 to 3. 10. 1980 in the stretch of Tisza at Tiszafüred were used. Standard body lengths of animals (L_c) — distance from nose tip to the base of the caudal fin — varied between 290 mm and 870 mm, and their body weights (W) between 300 g and 7700 g.

The relation between body length and body weight was calculated on the basis of the formula recommended by TESCH (1968):

$$W = a\,L^{b}$$

resp. its logarithmic form:

$$\lg W = \lg a + b \lg L,$$

where W = body weight of fish, L = body length, and a and b are constants. The function was fitted to the data by means of the least square method according to SVÁB (1973).

Values of the condition factor (CF) were calculated according to HILE (1936) on the basis of the following relationship:

$$CF = \frac{W}{L^3}$$

where W = body weight in g, L = body length in mm.

Age determinations were performed on the basis of the annuli of scales. Of the scales taken from each fish, 6 were put into slide frames and projected on a blind plexiglas plate by means of a slide projector and on the ten times magnified picture the whole oral radiuses of scales (s) as well as the distance of each winter annulus from the focus of the scale (s_n) were measured with a scale of mm graduation.

The regression analysis performed with the data of whole scale radiuses and body lengths revealed the following relationship (Fig. 1):

$$L_c = 64.70 + 78.558s$$

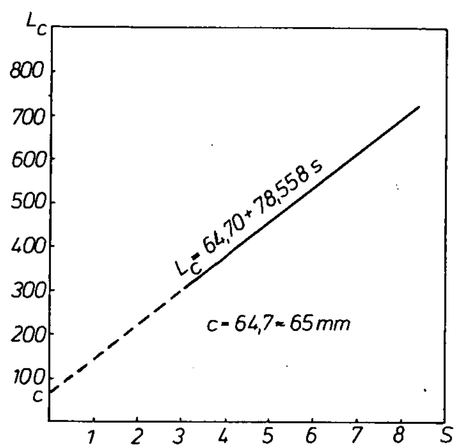


Fig. 1. Relation between standard length (L_c) and the whole radiuses of scales (s) (both in mm) The correction member (c) is given by the point of intersection of the line on the ordinata.

The line does not pass through the origo, i.e. there is no linear proportionality between body length and scale radius, on the other hand, the correction term: c = 65 mm necessary for the back-computation of body length can be obtained from this equation.

Body length of fish at the development of each annulus was back-computed by the method recommended also by TESCH (1968), according to FRASER (1916) and LEE (1920) on the basis of the following relationship

$$l_n = c + \frac{s_n}{s}(L - c),$$

where l_n = body length at the development of the annulus "n", c = the above mentioned correction member and s_n = the distance of annulus "n" from the focus, s = the total scale radius, L = body length at the time of sampling.

For the description of the growth of the pike population, WALFORD's method (1946) and BERTALANFFY's (1957) mathematical growth model recommended also by DICKIE (1968) were used.

Walford claims that the following relationship exists between body length (l_t) and the body length of the preceding year (l_{t-1}):

$$l_t = a + bl_{t-1}$$

According to Bertalanffy, body length (l_t) can be expressed at any t point of time (year) with the following equation:

$$l_t = L_\infty[1 - e^{-K(t-t_0)}],$$

where L_∞ = the maximal (asymptotic) body length; K = growth rate at which body length approximates L_∞, t_0 = the hypothetical time point at which body length is equal to zero; e = the base of natural logarithm.

The distribution according to age group of the 204 fish used in the examinations was the following: (1+): 3 fish, (2+): 89 fish, (3+): 82 fish, (4+): 21 fish, (5+): 6 fish, (7+): 1 fish, (8+): 1 fish, (9+): 1 fish. Though the markings were the usual ones, according to which e.g. (1+) = two-summer-old, (2+) = three-summer-old, etc., there were also such specimens which were caught at the end of first year of their life (catchings in March), when namely the development of the winter growth-ring had just ended. Such specimens were ranged into the next summer age group, e.g. the two-year-old ones figure in the age group of (2+), namely in the group of the three-summer-old fish.

Results

The relationship between body length and body weight of pike can be described by the following allometric equation:

$$\lg W = -4.811 + 2.930 \lg L_c,$$

where W is given in g, and L_c in mm (Fig. 2).

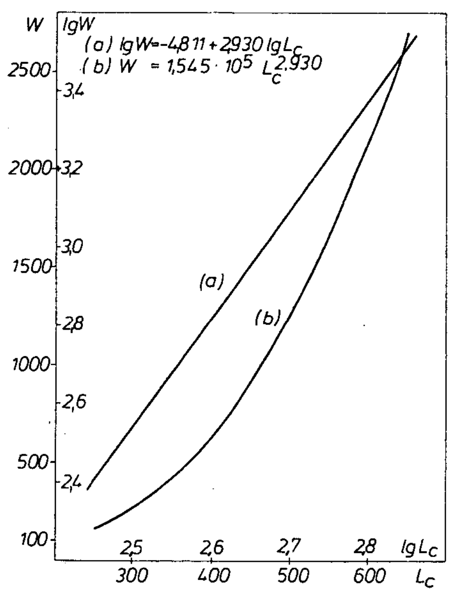


Fig. 2. Allometric relation between body length and body weight. L_c = standard body length in mm, W = body weight in g.

Table 1. *Body lengths of pike obtained by back-computation on the basis of scales (Standard length in mm, body weight in g)*

		(1+)	(2+)	(3+)	(4+)	(5+)	(7+)	(8+)	(9+)	L_c	W
	a	291	197	164	171	224					
l_1	b	329	313	333	311	283					
	c	314	251.2	245.9	237.9	259.5	281	224	247	249.5	163
	a		267	235	238	336					
l_2	b		445	476	451	435					
	c		359.6	356.4	340.7	397.3	418	330	370	367.4	507
	a			301	316	423					
l_3	b			582	543	561					
	c			434.6	425.8	508.7	556	429	493	474.5	1073
	a				372	503					
l_4					642	653					
	c				488.2	593.3	634	514	597	565.3	1791
	a					583					
l_5	b					704					
	c					648.7	713	549	662	643.2	2615
l_6							782	598	707	695.7	3291
l_7							831	641	753	741.7	3970
l_8								676	798	737.0	3897
l_9									833	833	5578

a: minimum, b: maximum, c: average within an age group, L_c: averages of the age groups, W: body weight.

Considering the fact that in many cases the whole length is given instead of the standard length, it is advisable to know the relation between the two:

$$L_t = 5.651 + 1.110 L_c$$

Table 1 presents the values of the body lengths of the studied age groups in the different years, as calculated on the basis of the growth-rings of scales.

In the computation of the combined averages of age groups the data of the age group (1+) were not considered, since owing to the mesh size of the fish-baskets used for collecting, only specimens of fast growth were caught, and these did not represent the actual conditions of measurement of the particular age group.

In the column "Body weight" of Table 1, values of body weights corresponding to average body length and calculated on the basis of the allometric equation described in the foregoing are given.

Using the average values of the body lengths of the single age groups, WALFORD's growth line was constructed together with the $x=l_{t-1}$ data pertaining to $y=l_t$ (Fig. 3).

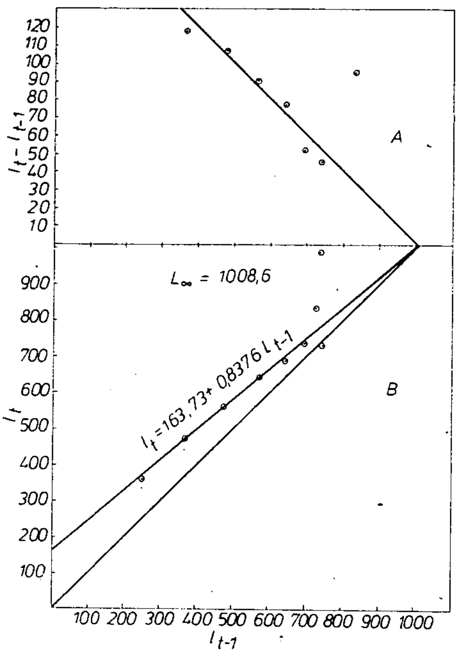


Fig. 3. Alternative illustration (WALFORD-plot) of the differences between the body lengths of consecutive years (A), and the values of body lengths in successive years (B). (l_t: body length at the age of "t", l_{t-1}: body length one year earlier, in mm). Asymptotic body length: 1008.6 mm is given by the abscissa value of the point of intersection of the line fitted to the points and the diagonal drawn at an angle of 45 degrees from the origo.

The line fitted to the points by means of the linear regression analisis can be described by the following equation:

$$l_t = 163.733 + 0,8376\ l_{t-1}$$

from which the asymptotic body length is

$$L\infty = \frac{a}{1-b} = 1008,6 \text{ mm}.$$

If the values for $\ln(L\infty - l_t)$ are represented in the function of time, we obtain a line (Fig. 4) which can be described with the following equation:

$$\ln(L\infty - l_t) = 6.7898 - 0.1695t.$$

From this we can determine the other parameters of BERTALANFFY's equation:

$$t_0 = \frac{\ln L\infty - a}{b} = -0.746 \approx -0.75 \text{ year},$$

$$K = \frac{\ln L\infty - \ln(L\infty - l)}{t - t_0} = 0.1695$$

Thus the equation describing the growth of the pike population of the river section is

$$l_t = 1008.6\,[1 - e^{-0.1695(t+0.75)}]$$

Fig. 5 shows the average body lengths obtained by back-computation on the basis of this equation for the single years.

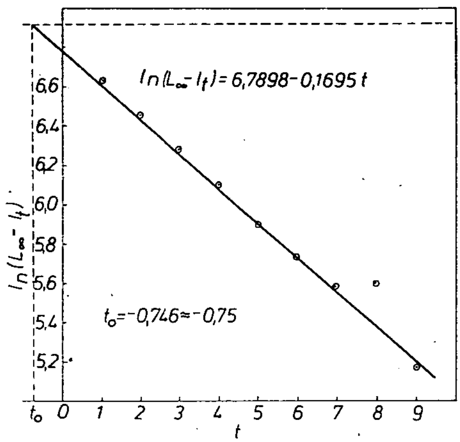


Fig. 4. Illustration of the natural logarithm of the lack of unsaturation (the difference of asymptotic body length and body lengths in the single years in mm) in the function of time. The constant of BERTALANFFY's equation is given by the rise of the line.

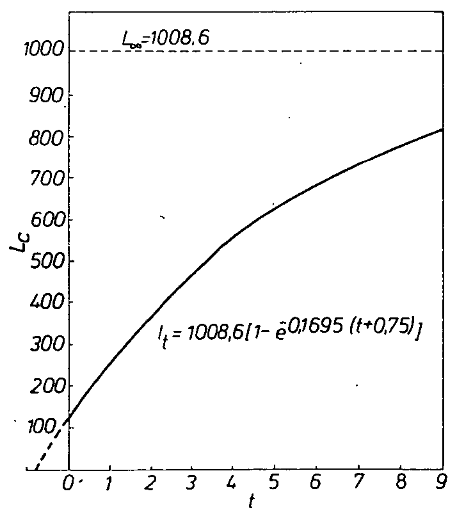


Fig. 5. Growth of pike according to the growth model proposed by BERTALANFFY (L_c = standard length in mm, t = time in years).

Discussion

It became evident as soon as the data of the caught fish were recorded, that there were considerable differences in weight between specimens of identical length. In addition to the amount of food found in the stomach, another factor was also instrumental in that, namely, owing to the fact that collecting was performed continuously, specimens worn by spawning and autumn ones in best physical condition were equally represented in the examination material. This mode of sample taking can be more useful if we want to obtain a picture on the average condition of the population.

The value of the b constant of the equation, i.e. that of the so-called allometric exponent expressing the relation between length and weight was less than 3 (2.930), showing that the growth rate of body weight of pike fell behind the growth rate of body length, and suggests that with the increasing of body length the condition of fish worsened somewhat, as it is seen in Table 2. Just the reverse of that could be observed in the case of the pike-perch population of this stretch of the Tisza, despite the fact that sample taking was here too continuous (HARKA 1977). Since there are no data at our disposal in connection with other places, it cannot be decided whether this low value of the exponent ($b<3$) is characteristic of the species, or the local population only.

Only in a small proportion of the scales examined where the annuli as discernible as in Fig. 6. Thus the possibility of error cannot be excluded in the establishing of the age of older specimens, resp. in the determination of the radiuses of the growth-rings. Because of this, the results obtained are rather of exploratory nature, and ignoring the finer changes of growth rate, only the growth process itself will be discussed.

Int he Tisza, the growth of pike is rather unequal, as it is apparent from the data contained in Table 1. In addition to natural unequal growth, another factor also contributes to the variation of body lengh of specimens of identical age, namely that with the more drastic changes of the water level the fish leave their natural environment and thus the population of the river bed and that of the storage area providing more advantageous conditions for fish are exchanged in some measure. However, for the high bank of the river bed, there is no possibility for a continuous exchange at the present level of impounding and therefore the growth data still pertain fistly to the impounded section of the river and the affluents in constant connection with it.

For the description resp. modelling of growth, the methods recommended by WALFORD and BERTALANFFY were used. Table 3 contains data on body lengths for

Table 2. *Changes in body length, weight and condition of pike*

Age year	Standard length mm	Total length mm	Body weight g	Condition 10^5 CF
1	259	293	182	1.0475
2	376	423	542	1.0196
3	475	533	1076	1.0039
4	558	625	1724	0.9923
5	628	703	2438	0.9844
6	687	768	3172	0.9783
7	734	820	3850	0.9736
8	780	871	4601	0.9695
9	815	910	5232	0.9665

Table 3. *Comparison of standard lengths calculated by Walford's method, Bertalanffy's equation and on the basis of scales*

Age year	Body length (mm) calculated on the basis of		
	scales	WALFORD'S method	BERTALANFFY'S equation
1	249.5	300.9	258.8
2	367.4	415.7	375.7
3	474.5	512.0	474.5
4	563.3	592.6	557.7
5	643.2	660.0	628.0
6	695.7	716.6	687.3
7	741.7	764.0	737.4
8	737.0	803.6	779.7
9	833.0	836.8	815.4

Table 4. *Growth of pike in some other areas in Europe (in cm)*

Age	After 1964 Bodensee	Hegemann Tuusala lake Finland	Ristić 1963 Yugoslavia	Present study	Domacsev S.U. Ilmen lake	Berg 1948 S.U. Dniester	Balon 1967 Slovakia	Gyurkó 1972 Romania	Present study
0+	12	9	—	—	—	—	—	—	—
1	—	—	—	29.3	24.5	—	23	23	25.9
1+	28	18	36	—	—	23.0	—	—	—
2	—	—	—	42.3	36.6	—	34	28	37.6
2+	42	27	46	—	—	31.0	—	—	—
3	—	—	—	53.3	48.8	—	42	34	47.5
3+	56	32	60	—	—	41.6	—	—	—
4	—	—	—	62.5	61.0	—	47	41	55.8
4+	68	38	70	—	—	—	—	—	—
5	—	—	—	70.3	—	—	59	45	62.8
5+	77	50	78	—	—	—	—	—	—
6	—	—	—	76.8	—	—	68	49	68.7
6+	89	56	83	—	—	—	—	—	—
7	—	—	—	82.0	—	—	76	55	73.4
7+	98	65	—	—	—	—	—	—	—
8	—	—	—	81.7	—	—	—	61	78.0
8+	107	69	89	—	—	—	—	—	—
9	—	—	—	91.0	—	—	85	—	81.5
9+	114	73	—	—	—	—	—	—	—
	Total length					Standard length			

The values relating to Yugoslavia are averages computed from the data pertaining to the back-water of Biserno ostrovo at Csurog, which was studied by RISTI .

DOMACSEV's data were taken over from BERG (1948).

the single years of life as estimated on the basis of the two relationships. Comparison of these with the measurements computed on the basis of scales shows, that the values computed according to BERTALANFFY render a much better approach possible. We can accept BERTALANFFY's equation for the description of the growth rate of the pike population not only because it is more modern, but also because it permits a more exact approach.

Since there are no other data available concerning the growth of pike in Hungary, we can perform comparison only with other areas of Europe (Table 4).

Comparison is, however, very difficult, since the age of fish is given by some authors in summers, by others in whole years, and body length is given also either in whole length (L_c) or in standard length (L_c). For the sake of a better survey, the ages expressed in summers and years are shown in increasing order in a table, and both the whole and the standard lengths of the Tisza population are also presented there.

The growth of pike in the stretch of the Tisza at Tiszafüred bears greatest resemblance to Slovakian and Yugoslavian data, and is faster than than those of the pike populations of the Dniester and Rumania.

Because the data reported here primarily pertain to a river — even though it is an impounded section of the river — there is reson for believing that the growth rate of pike is favourable in the whcle storage area.

References

BALON, E. K. (1967): Ryby Slovenska. — Bratislava.

BERG, L. SZ. (1948): Rübü presznüh vod S.S.S.R. i szopredelnüh sztra. I. — Moskow, Leningrad.

BERTALANFFY, L. (1957): Quantitative laws in metabolism and growth. — Q. Rev. Biol. *32*, 217—231.

DICKIE, M. L. (1968): Mathematical models of growth. In: RICKER (ed.): Method for assessment of fish production in fresh waters. — Oxford and Edinburgh.

FRASER, C. (1916): Growth of the spring salmo. — Trans. Pacif. Fish. Soc. Seattle, for 1915, 29—39.

GYURKÓ, I. (1972): Our freshwater fishes (in Hungarian). — Bucharest.

HARKA, Á. (1977): Growth of pike-perch *(Lucioperca lucioperca* L.*)* in the Tisza stretch at Tiszafüred. — Tiscia (Szeged) *12*, 109—115.

HEGEMANN, M. (1964): Der Hecht. Wittenberg Lutherstadt.

HILE, R. (1936): Age and growth of the cisco, *Leucichthys artedi* (LE SUEUR), in the lakes of the northeastern highlands, Wisconsin. — Bull. Bur. Fish. U.S. 48. *19*, 211—317.

LEE, R. M. (1920): A review of the methods of age and growth determination in fishes by means of scales. — Fishery Invest. Lond. Ser. 2.4.2. 32.

PINTÉR, K. (1980): The pike *(Esox lucius* L.*)* (in Hungarian). — Halászat *26*, Suppl. *1*.

RISTIĆ, M. D. (1963): Nova saznanja u kumpleksu problema vestackog razmnozsavanja stuke-

RISTIĆ, M. D. (1963): Nova saznanja u kumpleksu problema vestackog razmnozsavanja stuke — *Esox lucius* L. Ribarstvo Jugoslavije, Zagreb *18*, *6*. 153—158.

SVÁB, J. (1973): Biometric methods in research (in Hungarian). — Budapest.

TESCH, F. W. (1968): Age and growth. In: RICKER (ed.): Methods for assessment of fish production in fresh waters. — Oxford and Edinburgh.

TONER, E. D. (1966): Synopsis of Biological Data on the Pike *(Esox lucius* L. 1758). — FAO, Roma, 1966 (mimeographed material).

WALFORD, L. A. (1946): A new graphic method of describing the growth of animals. — Biol. Bull. mar. biol. Lab. Woods Holc *90*, 141—147.

A csuka (Esox Lucius L.) növekedése a Tisza folyó Tiszafüredi szakaszán

HARKA Á.

Kossuth Lajos Középiskola, Tiszafüred, Magyarország

Kivonat

A vizsgált 204 halpéldány alapján a csuka standard testhossza és testtömege közötti összefüggés a következő:

$$\lg W = -4{,}811 + 2{,}930 \lg L_c,$$

ahol W a testtömeg g-ban, L_c a testhossz mm-ben.

A standard testhossz a teljes testhosszal az alábbi viszonyban áll:

$$L_t = 5{,}651 + 1{,}110L_c.$$

A csuka korának és az egyes életévekben elért testhosszának a meghatározása pikkely-évgyűrűk alapján történt. A növekedés jól leírható a Bertalanffy-egyenlettel:

$$l_t = 1008{,}6\ [1 - e^{-0{\cdot}1695\ (t+0{\cdot}75)}],$$

amelyben l_t a csuka standard hossza t éves korban, e a természetes logaritmus alapszáma.

Rast štuke (Esox lucius L.) na deonici reke Tise Tiszafüred

HARKA Á.

Srednja škola „Kossuth Lajos”, Tiszafüred, Hungaria

Abstrakt

Odnos izmedju standardne dužine i težine tela štuke na osnovu 204 analiziranih primeraka iznosi:

$$\lg W = -4{,}811 + 2{,}930 \lg L_c,$$

gde je W težina u g, L_c dužina tela u mm.

Standardna dužina sa opštom dužinom tela stoji u sledećem odnosu:

$$L_t = 5{,}651 + 1{,}110L_c.$$

Utvrdjivanje starosti i u pojedinim godinama dostignutog rasta stuke vršeno je na osnovu godova-prstenova na krljuštima. Prirast je izražen jednačinom po Bertalanffy-u:

$$l_t = 1008{,}6\ 1 - e^{-0{\cdot}1695\ (t+0{\cdot}75)}],$$

gde je l_t standardna dužina štuke u t uzrastu, dok je e osnovni broj prirodnog logaritma.

ПРИРОСТ ЩУКИ (ESOX LUCIUS L.) НА ТИСАФЮРЕДСКОМ УЧАСТКЕ РЕКИ ТИСЫ

А. Харка

Средняя школа им. Лайоша Кошута, Тисафюред, ВНР

Резюме

На основании проведенных исследований на 204 экземплярах рыб, взаимосвязь между стандартной длиной щуки и массой её тела следующая:

$$\lg W = -4{,}811 + 2{,}930 \lg L_c,$$

где W масса тела в граммах, L_c — длина тела в миллиметрах.

Стандартная длина тела с максимальной длиной тела находитса в нижеследующем отношении:

$$L_t = 5{,}651 + 1{,}110\ L_c$$

Век щуки ежегодный прирост длины тела определяется на основании годичных колец чешуи. Прирост хорошо может быть выражен уравнением Бертолонффи:

$$l_t = 1008{,}6\,[1 - {}_e - 0{,}1695\ (t + 0{,}75)]$$

где l_t стандартная длина шуки t — в годичном возрасте, e естественное основное число логарифма.

Tiscia (Szeged) Vol. XVIII, pp. 113—117 (1983)

GROWTH OF SOME SPECIES OF FISHES IN THE TISA RIVER

S. MALETIN and LJILJANA BUDAKOV

Institute of Biology, Faculty of Sciences, Novi Sad
Provincial Bureau for Environment Protection, Novi Sad
(Received 10 November, 1981)

Abstract

On the basis of the material collected in the period 1979–1982 on the locations of Padej and Titel (the total of 69 specimens of *Esox lucius* L. and 74 specimens of *Abramis ballerus* L. was studied) longitudinal growth and growth tempo were reconstructed and growth rate and growth constant calculated. The growth tempo of *E. lucius* and *A. ballerus* reaching peaks in the first and second year and than decreasing with age (greatest drop is after second year). According to the growth rate and growth constant two periods are observed: the first up to the third year and the second after this point.

Introduction

The Ichthyofauna of the Yugoslav section of the Tisa was the subject matter of studies by RISTIĆ, 1977; GRGINĆEVIĆ, 1977; BUDAKOV et al. 1979; MALETIN et al. 1980; GRGINĆEVIĆ et PUJIN, 1980. This study is a contribution to the research of ichthyofauna of the Tisa. This case study deals with a fish of prey *Esox lucius,* economically and ecologicaly important species and its prey *Abramis ballerus,* a less valuable species.

Materials in Methods

The material has been collected from 1979 through 1982 on the locations of Padej and Titel. The total of 69 specimens of *E. lucius* and 74 specimens of *A. ballerus* was studied. The body length without caudal fin was measured, longitudinal growth and growth tempo were reconstructed and growth rate and growth constant calculated.

Results and Discussion

The age of specimens of *E. lucius* is 2+ to 6+ (Table 1). The average body length increases with age. In addition, the absolute and relative gain are also shown.

Table 2 shows calculated longitudinal growth of *E. lucius* ranging between 12.75 cm for l_1 to 43.94 cm for l_6. In addition, the growth tempo reaching peaks in the first two years and than decreasing are also shown.

According to the growth rate and growth constant two period are observed: up to three years and over three years (Table 3).

Table 1. Length increase of *Esox lucius* L. in Tisa river (measured lengths in cm)

Age group	n	Length average (cm)			Absolute increase (cm)	Relative increase %
		min	max	M		
2+	1	—	—	27.10	—	—
3+	14	31.00	49.20	38.23	11.23	29.11
4+	30	28.60	50.00	39.67	1.44	3.62
5+	22	35.00	55.30	42.95	3.28	7.63
6+	2	46.10	59.70	52.90	9.95	18.80

Table 2. Length increase of *Esox lucius* L. in Tisa river (calculated lengths in cm)

Year	n	l_1	l_2	l_3	l_4	l_5	l_6
1980	1	13.13	20.98	—	—	—	—
1979	14	15.58	26.37	32.84	—	—	—
1978	30	12.91	22.96	30.76	36.50	—	—
1977	22	11.76	20.53	28.74	34.85	39.30	—
1976	2	10.39	19.21	28.04	36.47	40.58	43.94
M	69	12.75	22.01	30.09	35.94	39.94	43.94
Absolute increase (cm)			9.26	8.08	5.85	4.00	4.00
Relative increase %			72.62	36.71	19.44	11.12	10.01

Table 4 shows the longitudinal growth of *A. ballerus* as well as absolute and relative gain. The age of specimens is 2+ to 4+. The average value increases withage.

Table 5 shows calculated longitudinal growth of *A. ballerus* ranging from 9.68 cm for l_1 to 20.5 cm for l_4. .In addition, the growth tempo reaching peaks in the first and second year and than decreasing with age is also shown (greatest drop is after second year).

Table 6 shows the growth rate and growth constant. There are also two periods: the first up to the third year and the second after this point.

The average values of measured lengths of *E. lucius* from the Tisa are slightly lower than those from Obedska bara and Koviljski rit (flooded areas of the Sava and the Danube). Calculated values of body lengths range between those from Obedska bara and Koviljski rit. However, growth tempo is higher compared to these two areas. Growth rate and growth constant decrease after the third year, while in Obedska bara and Koviljki rit this drop occurs after the second year (BUDAKOV et MALETIN 1982).

Table 3. Rate of growth (C) and constant of growth (K) of *Esox lucius* L. in Tisa river

Age group	Length average (cm)	C	K
1	12.75	—	—
2	22.01	0.15	1.65
3	30.09	0.25	2.16
4	35.94	0.08	0.55
5	39.94	0.06	0.29
6	43.94	0.04	0.16

Table 4. Length increase of *Abramis ballerus* L. in Tisa river (measured lengths in cm)

Age group	n	Length average (cm)			Absolute increase (cm)	Relative increase %
		min	max	M		
2+	16	19.00	24.50	21.86	—	—
3+	44	12.10	28.20	22.67	0.81	3.57
4+	14	19.10	26.30	27.82	5.15	18.51

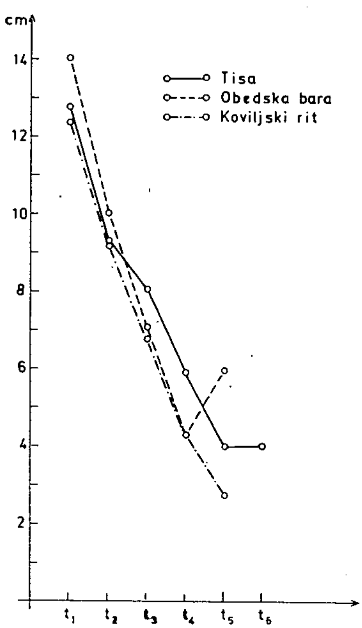
Table 5. Length increase of *Abramis ballerus* L. in Tisa river (calculated lengths in cm)

Year	n	l_1	l_2	l_3	l_4
1981	7	12.38	18.36		
1980	25	9.44	15.75	19.84	
1979	10	9.07	14.75	18.92	20.64
1978	9	10.86	18.96		
1977	19	8.67	14.02	18.53	
1976	4	7.67	13.49	17.48	20.37
M	74	9.68	15.28	18.69	20.50
Absolute increase (cm)			6.20	2.81	1.81
Relative increase %			64.04	17.69	9.68

Measured body length of *A. ballerus* is within the range given by GRGINEČVIČ (1977) according to her research in the Danube, Koviljski rit, canals Danube–Tisa–Danube, Jegrička and Mrtva Tisa. Calculated body lengths and growth tempo are lower in the tested area. Growth rate and growth constant of specimens from the Tisa decrease after the second year, while GRGINČEVIČ (1977) detected this decrease after the fourth year, even though she pointed to certain drop after the second year.

Table 6. Rate of growth (C) and constant of growth (K) of *Abramis ballerus* L. in Tisa river

Age group	Length average (cm)	C	K
1	9.68	—	—
2	15.88	0.14	1.11
3	18.69	0.04	0.18
4	20.50	0.09	0.20



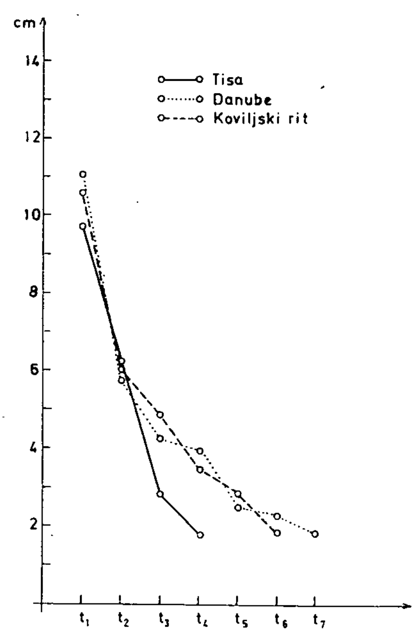


Fig. 1. The growth tempo of *Esox lucius* L. in Tisa, Obedska bara and Koviljski rit
Fig. 2. The growth tempo of *Abramis ballerus* L. in Tisa, Danube and Koviljski rit

References

BUDAKOV, LJ., PUJIN, V., MALETIN, S., MUČENSKI, V. (1979): Wachstum der Silberkarausche (*Carassius auratus gibelio* BLOCH) in der Donau und einigen Nebenflüssen in der Sozialistischen Autonomen Prowinz Vojvodina. — XXI Arbeitstagung der Internationale Arbeitsgemeinschaft Donauforschung, 202—208. Novi Sad.

BUDAKOV, LJ., MALETIN, S. (1982): Tempo porasta riba kao parametar kvaliteta vode. „Zaštita '82", Ohrid.

GRGINČEVIČ, M. (1977): Ekologija i problem hibridizacije vrste *Abramis ballerus* L. u nekim лodotocima Vojvodine. Doktorska disertacija odbranjena na PMF, Novi Sad.

GRGINČEVIČ, M., PUJIN, V. (1980): Prilog poznavanju taksonomskih karaktera vrste *Rutilus rutilus* L. u nekim vodotocima Vojvodine. — IV Simpozijum biosistematičara Jugoslavije, Derdap.

MALETIN, S., PUJIN, V., BUDAKOV, LJ. (1980): Variranje morfoloških karaktera *Carassius auratus gibelio* BLOCH (1783) (Cyprinidae) u nekim vodama Vojvodine. — IV simpozijum biosistematičara Jugoslavije, Derdap.

RČISTI, M. (1977): Ribe i ribolov u slatkim vodama. — Nolit, Beograd.

Egyes tiszai halfajok növekedése

MALETIN, S. és BUDAKOV LJILJANA

TTK Biológia Intézet, Novi Sad
Tartományi Természetvédelmi Hivatal, Novi Sad

Kivonat

A szerzők 1979—1982 között, Padéj és Titel környékéről begyűjtött 69 *Esox lucius* L. és 74 *Abramis ballerus* L. példányon tanulmányozták a hosszanti növekedést, valamint számítás alapján a növekedés ütemét. A növekedés az első és a második évben a legerőteljesebb az említett fajoknál. A második év után észlelhető a legnagyobb hanyatlás. A növekedés ütemében és konstansában két időszak különíthető el: az első a harmadéves korig, a második a harmadik év után.

Rast nekih vrsta Riba u Tisi

S. MALETIN i LJILJANA BUDAKOV

Institut za biologiju, PMF, Novi Sad
Pokrajinski zavod za zaštitu prirode, Novi Sad

Abstrakt

Na osnovu materijala sakupljenog u periodu 1979—1982. g. na lokalitetima Padej i Titel (ukupno je obradeno 69 primeraka *Esox lucius* L. i 74 primerka *Abramis ballerus* L.) rekonstruisan je dužinski rast i tempo rasta i izračunate su brzina i konstanta rasta. Tempo rasta *E. lucius* i *A. ballerus* pokazuje najveće vrednosti u prvoj i drugoj godini života, a zatim sa starošću opada (najveći pad je posle druge godine). U odnosu na brzinu i konstantu rasta uočavaju se dva perioda: prvi do treće i drugi posle treće godine.

РОСТ НЕКОТОРЫХ ВИДОВ РИБ В р. ТИССА

С. Малетин и Лиляна Будаков

Биологический институт ПМФ, г. Нови Сад
Краевой институт по защите природы, г. Нови Сад

Резюме

На основании материала, собранного в периоде с 1979 по 1982 гг. на территории г. Падей и г. Тител всего обработано 69 экземпляров *Esox lucius* L. и 74 экземпляров *Abramis ballerus* L. сделана реконструкция роста по длине и темпа роста, также вычислены скорость и постоянная роста. Самые большие значения темпа роста *E. lucius* и *A. ballerus* замечаются на одно- и двухлетнем возрасте, а потом понижается (самое значительное падение темпа роста — после двухлетнего возраста). Учитывая скорость и постоянную роста, замечаются два периода: Первый — до трехлетнего возраста и второй — после трехлетнего возраста.

Tiscia (Szeged) Vol. XVIII, pp. 119—122 (1983)

WINTERY ALIMENTATION OF WINTERING MALLARD MASSES ON THE REACH OF TISZA AT SZENTES—HÓDMEZŐVÁSÁRHELY BETWEEN 1971—1980

I. STERBETZ

Hungarian Ornithological Institute, Budapest
(Received June 20, 1981)

Abstract

The paper examines the questions of alimentation and secondary production of mallards wintering in a 30 km long reach of Tisza in the cross-section of 10 years, during the interval of December—February. It is established, that the food of mallards gathering on the ice-free flowing water is ensured in 80—90% by corns of maize found on stubble-fields. 8—10 000 mallards are wintering on the examined area and they ingest an amount of food wich is equal to 225.479 megacalories.

Introduction

The Mártély and Pusztaszer landscape protection areas on the 30 km long reach of Tisza between Hódmezővásárhely and Szentes are natural values of international importance according to so called Ramsari Convention and because of this their ecological research is especially interested. The strongly serpentine Tisza here is covered by ice very rarely, so it ensures favourable wintering place for swimming and merganser water birds. In the case of such species wich take advantage of this en masse the problem of food-basis comes into prominence, because only long-lasting and sufficient food-supply can ensure their settling for a considerable period.

Mallards *(Anas platyrhynchos* L.) represent the most important biomass among wintery water birds of Tisza, they are characteristic wintering species here. Their gathering is conspicuous from December till the end of February when their masses scattered on frozen waters assemble here. Only an unimportant part of their food originates from the river-bed. The food source of mallards is ensured by plough-lands bordering the river in 30—40 km width. In this paper we want to give answers to the questions that averagely how great mass of birds is gathering in the examined living-space, what is their dominant food and how great values of calories menas the secondary production originating from this. We want to conclude the economic role and prospects of mallard masses wintering here like a practical utilization of all these.

Materials and Methods

The examined area is the 30 km long reach of Tisza taking up position northwards from Szeged—Fehértó main channel on the area of Pusztaszer and Mártély landscape protection areas. Its central co-ordinates are: 46° 25'—20° 20". I made mallard counting twice a month between

1971—1980 in December—January and February. I signed the amount indicated for one month with the mean of results. I collected monthly 5-5- individuals, so at the end of examination I had 150 stomach-content. From these the average daily food weight falling to one bird is 0.13 kg on the basis of this I made further calculations. I show in table the bird amount observed during 10 years. On the basis of individualnumbers falling to one year I calculated the average weight of consumed food according to percentage rate established from stomach content. I unified the single food-types converted into starch-value on the basis of tables established for the calculation of fodder-standards of domestic animals (the starch-value is a number wich informs about the total energetic nutrition power of single food-types. It expresses the food-value of lipoids, carbonhydrates, and proteins being in the food and indicates how much isolated starch is equal with 1 kg of examined food). Calory easily can be reckoned from starch-value, because 1 kg starch is equal with 2356 kilocalories resp. 2.356 megacalories (BAITNER 1966, HEROLD 1977).

Table 1. *Monthly average amounts of mallards*

Year	December	January	February
1971	1,650	1,400	1,850
1972	1,200	1,600	2,900
1973	1,980	2,500	3,800
1974	1,280	16,000	19,200
1975	12,800	12,000	14,500
1976	15,800	850	22,000
1977	8,000	20,000	14,800
1978	12,000	25,000	15,000
1979	19,500	12,000	17,000
1980	13,200	12,500	19,600
Average individualnumber:	8,750	10,280	13,060

Results

From the data obtained according to described method it is clear that the examined part of Tisza river valley is important gathering place of mallards during winter. The dominant food-basis is ensured by corns of maize, rice and weeds during this time. The role of maize is prominent wich is the result of technically not economic mechanical harvesting. It is obvious from the table that the amounts of mallards are increasing towards the end of examined period of time. The increasing tendency is in connection with the spreading of mechanical maize-harvest. Similar phenomenon can be experienced in the near Kardoskút landscape protection area in the case of mallards, cranes and wild-geese (STERBETZ 1979). I could determine the next species from the food eated in Tisza valley: *Chara* sp., *Lemna* sp., Cyprinidae sp., Chironomidae sp., remnants of aquatic insects, *Dreissena polymorpha,* remnants of *Planorbis.* But these enumerated foods were present only in traces their amount can't be valued percentally.

Discussion

The monocultural maise-cultivating systems near Tisza are very favourable wintery bases from the point of view of nature conservation. The harvest remained and scattered on stubbles ensures food for a great amount of granivorous birds here.

The ice-free flowing water and the safe food basis together lead to the development of traditions in the case of migratory mallards, its initial signs are already appearing obviously. Culture corn taken up in great quantities and calory-value is economic advantage because the remained corns should be lost but so they are utilized as valuable game by huntable mallards.

Table 2. *Calory-value of food taken up in the average of 10 years expressed in megacalories*

Month	Individual-number of mallards	Maize	Rice	Weed-corns	Total starchvalue kg	Mega-calory
			kg			
December	8,750	29,972 (85%)	1057 (3%)	4233 (12%)	25,393	59,826
January	10,280	39,356 (95%)	1657 (4%)	415 (1%)	32,898	77,508
February	13,060	45,636 (96%)	951 (2%)	951 (2%)	37,413	88,145
Totally	32,090	114,964 (92%)	3665 (3%)	5599 (5%)	95,704	225,479

References

BAITNER, K. (1976): Gazdasági állatok takarmányozása. In: Állattenyésztés (Forage of domestic animals. In: Animal husbandry). Szerk. HORN, A. — Budapest.

HEROLD, I. (1977): Takarmányozás (Forage). — Budapest.

STERBETZ, I. (1979): The role of the maize monocultures in the food basis of the migration of waterfowl. — Állattani Közlem. Budapest 153—159.

Telelő tőkés réce (Anas platyrhynchos L.) tömeges téli táplálkozása a Tisza Szentes—Hódmezővásárhelyi szakaszán, 1971—1980 időközében

STERBETZ I.

Magyar Ornithológiai Intézet, Budapest, Magyarország

Kivonat

Az adatokból kitűnik, hogy a Tisza folyóvölgyének vizsgált szakasza téli időszakban jelentős vadréce gyülekezőhely. A tőkés récék domináló táplálékbázisát ebben az időszakban a környező szántóföldeken talált kukorica, rizs és gyommagvak biztosítják. Kiemelkedő itt a kukorica szerepe, amely a technikailag nem kellően gazdaságos gépi munka eredménye. A táblázatból szembetűnő, hogy a megfigyelt récemennyiségek a vizsgálati ciklus vége felé egyenletesen emelkednek. Ez a növekvő tendencia a gépesített kukoricabetakarítás elterjedésével áll összefüggésben. Hasonló jelenségek tapasztalhatók a közeli Kardoskúti-természetvédelmi területen a tőkés récék, vadludak és darvak esetében is (STERBETZ 1979). A Tisza völgyében felvett táplálékból az alábbi fajokat lehetett megállapítani: *Chara* sp, *Lemna* sp, Cyprinidae sp, Chironomidae sp, vízirovar maradványok, *Dreissena polymorpha, Planorbis* sp. törmelék. E felsoroltak azonban csak nyomokban voltak jelen, mennyiségük százalékosan nem értékelhető.

Masovna ishrana divlje patke (Anas platyrhynchos L.) na deonici Tise Szentes—Hódmezővásárhely tokom zimovanja u periodu 1971—1980. godine

STERBETZ I.

Ornitološki institut, Budapest, Hungaria

Abstrakt

Iz podataka je uočljivo da se istraživana deonica reke Tise javlja kao značajno zimsko sabiralište divlje patke. U toku zimske sezone u ishrani divlje patke dominira kukuruz, rizž i zrnevlje korovskih biljaka sa okolnih poljoprivrednih kultura. Značajna količina kukuruza se javlja usled tehnički nedovoljno ekonomičnog mašinskog branja. Iz tabele je uočljivo da se jata divlje patke ravnomerno povećavaju do kraja ciklusa posmatranja. Ova rastuća tendencija je u zavisnosti sa obimom mašinskog branja kukuruza. Slične su pojave uočene i na području nedalekog zaštićenog okruga Kardoskút u odnosu na divlju patku, divlje guske i ždralove (STERBETZ 1979). U ishrani divlje patke u dolini reke Tise još učestvuju u tragovima sledeće vrste, čija je količina u procentima beznačajna: *Chara* sp., *Lemna* sp., *Cyprinidae* sp., *Chironomidae* sp., ostaci vodenih insekata, *Dreissena polymorpha, Planorbis* sp.

МАССОВОЕ ЗИМНЕЕ ПИТАНИЕ КРЯКВЫ ОБЫКНОВЕННОЙ (Anas platyrhynchos L.), ЗИМУЮЩЕЙ НА УЧАСТКЕ РЕКИ ТИСЫ СЕНТЕШ—ГОДМЗЕВВАШАРХЕЛЬ, В ПЕРИОД 1971 Д1980 ГГ.

И. Штернбетз

Венгерский орнитологический институт, Будапешт

Резюме

Согласно данных, полученных на основании приведенной методики, выявляется, что исследованный участок долины реки Тисы в зимний период является типичным местом сбора кряквы. Основной базой, обеспечивающей питание кряквы обыкновенной в пору этого года являются кукурудза, рис и семена сорных растений, произрастающих в окресностях на возделываемых полях. Преобладающая роль принадлежит здесь кукурудзе, что является результатом технического несовершенства работы сельськохозяйственных машин.

Из таблицы видно, что количество крякв к концу цикла исследования беспоерывно увеличиваотся.

Эта возрастающая тенденция находится в зависимости от распространения машинвой уборки кукурудзы. Случай подобных явлений с кряквой, гусем и журавлем можно наблюднть также на ближайшей Кордошкутской заповедной территории (Штербетз 1979). Из кормов, собранных в долине реки Тисы, удалось определить такие виды: CHARA sp., LEMNA sp.- CYPRINIDAE sp., CHIRONVMIDAE sp. остатки водных наекомых, отходы *Dreissena polyniorpha* встречаются здесь только в следах. Численность их в процентах не может быгь оценена.

Tiscia (Szeged) Vol. XVIII, pp. 123—131 (1983)

THE ORNITHOLOGICAL INVESTIGATION ON THE FORESTS OF "TISZADOB FLOOD BASIN" NATURE CONSERVATION AREA

A. LEGÁNY

Northern Great Plain Inspectorate of OKTH, Debrecen
(Received 31 December, 1981)

Summary

The author investigated the bird-communities of the forests of "Tiszadob flood basin" nature conservation area in order to give useful advices about nature conservation. During the comparative analises he ascertained the following facts:

1. The bird-community typical of the hardwood groves of the flood basin developed during a long process, which is characterized by the dominancy of small insectivorous song-birds. The proportion of top-predatories represented by carnivores is very low. During the development the hollow-dwellers grew in proportion and in role.
2. On the examined flood basin a gradual reconstruction of the old hardwood grove becomes necessary without last utilization and without endangering the extremely rich bird-community living there. Sylviculture must not be introduced here.
3. Should Populeto cultum be last utilized, the renewal must happen with robur. In the planted robur-forests sylviculture is allowed.
4. If we keep to the rules mentioned above we can expect natural forests and bird-communities, and this is the main aim of nature conservation here.

Introduction

The Tisza was a decisively determinant river in our country's ancient scenery. Her floods covering large areas formed the largest marsh of Central Europe. The river control however hindered the roving water and made the large reedies and gallery forests of the flood basin disappear. We have only poor remains of all of those natural values that characterized the river a hundred years ago. So it is quite understandable that nature conservation preserved the remaining valuable areas. One of them is "Tiszadob flood basin", which — with its 1000-hectare surface 2471 acres) — is an important member among the preserved areas near the river. (See diagram 1.) Since the preservation was justified by the forests and the fauna — mainly birds — typical of flood basins, a deep ornithological analysis was needed, which can give useful advices to nature conservation as well. Data about the area in the ornithological literature were published by only the author of this work — Legány 1964, 1965 — but these data partly have become out of date, partly they are not enough to be the basis of nature conservation.

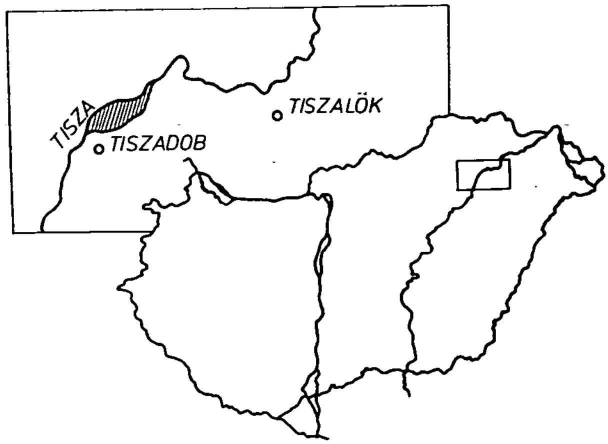


Fig. 1. The situation of "Tiszadob flood basin" nature conservation area in Hungary.

Materials and Methods

Most of the nature conservation area is covered with forests, in which sylviculture has been introduced. Sylviculture can affect — negatively or positively — the further survival of the living world here. That is why I choose the places of ornithological survey so as to be able to get useful information about the birds of the different — in age and in conbination of species — forests and about the direction of the community's changes both in quantity and quality. I choose the following places of survey: (See diagram 2 for the spatial distribution of these places.)

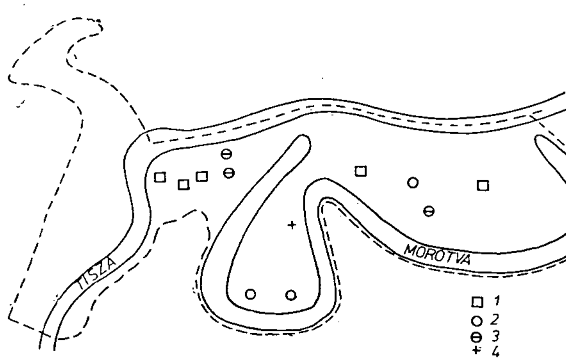


Fig. 2. The distribution of the places of investigation on the examined area
Key to the signs used: - - - border of the nature conservation area, + spruce-forest, □ oak-forest, O ash-forest, ∅ Populeto cultum.

1. *Quercus robur* planted 15 years ago. It is characterised by thick shrub stratum of *Cornus sanguinea* and *Rubus caesius.*
2. *Quercus robur* planted 25 years ago. Thick shrub stratum of *Cornus sanguinea, Ulmus laevis* and *Acer negundo.*
3. *Quercus robur* planted 30 years ago. Thick shrub stratum of *Cornus sanguinea.*
4. *Quercus robur* planted 50 years ago. Thick shrub stratum of *Sambucus nigra* beside *Cornus sanguinea.*
5. The remains of a 150—200-year old hardwood gallery forest — *Querco-Ulmetum* — which consists of sometimes decaying *Quercus robur, Populus alba, P. nigra* and *Ulmus laevis.*

The shrub stratum is not so thick as in the first four cases, and mainly consists of *Cornus sanguinea* and *Sambucus nigra*. The big, old trees have become hollow and this fact is decisively determines the combination of the bird-community. There is no sylviculture introduced here.

6. Old — 50—60-year old — ash-forest *(Fraxinus angustifolia)* in which planned sylviculture has been introduced. They are probably planted forests, but oak- and elm-trees have appeared in them because of their old age. Their shrub stratum — consisting of *Sambucus nigra* and *Cornus sanguinea* — is thin. In order to get acceptable information about the bird-community of ashforests I marked out places of survey on three different areas.

7. The area of Populeto cultum is not growing any more, but there is still a lot of them. They were mainly planted in the place of the old soft-wood groves *(Salicetum albae-fragilis)*. Considering the fact that these areas are not suitable *for birds at all* — LEGÁNY (1974) — I found it necessary to examine their role. That is why I marked out three places of survey in the case of ash-forests.

8. *Picea excelsa* are completely alien to the character of the area. These trees appear in some small groups on the flood basin, as the developed remains of old Christmas-tree forests. I intended to make clear their role and importance as well, so I marked out a place of survey here, too.

The surface of the places was 1 hectare (=2.471 acres) that I had paced off then I measured it out with the help of a range-finder of a camera, and I took it into consideration that the place should be typical of the examined kind of forest, and in every case it could be identified by a characteristic tree, molehill, ditch etc.

In the classification of nidatories I considered every momentum that could prove the hatching of the birds, that is the singing cocks, the found nests, the parents that fed and lead to their nestlings, the egg-shells etc. The data tabulated here are all the results of the 1981 examinations.

The Results of the Examination

During the tabulation of the data of the survey we could examine the hatching of 46 bird species. Of course the bird-communities showed significant differences because of the existing ecological differences. (See table I)

I examined only the nesting avifauna because these species are present, take nourishment and multiplicate during the active life of the vegetation and the whole ecosystem, so their connection is close to the biocenosis they live in. The other reason for my decision was that these species are very important for nature conservation, so we have to concentrate on them.

As I mentioned and it is clear from Table I, there are measurable differences between each type of forest. That is why my aim was to find and define the reason for it in order to get closer to the understanding of the emergence of the bird-communities. In favour of this I analysed every stand in many respects. I examined the combination of species and the relative frequency-value of the species, and with the help of the Shannon—Wiener function

$$H_s = - \sum_{i=1}^{s} p_i \cdot \ln p_i$$

I went on counting and analysed the diversity-values. I find it important because these data clearly inform us not only about the multiplicity of the examined bird-community, but also about its entropy, i.e. its disorderliness. The effects of diversity and entropy are opposite to each other, i.e. the bigger is the diversity-value, the smaller is the entropy. So the order of the structure of the community grows.

As a result of the counts I got a regular line in degree — see Table 2 — where the growing diversity-values were parallel with the growing age of the forest. Of course I got the highest value in the case of the hardly disturbed hardwood grove.

Table 1. *The bird species examined on „Tiszadob flood basin"*

Species	P	P_c	O_{15}	O_{25}	O_{30}	O_{50}	O_{150}	A
1. *Anas platyrhyncos* L.							1	
2. *Falco subbuteo* L.							1	
3. *Falco tinnunculus* L.						1		
4. *Phasianus colchicus* L.		1						
5. *Columba oenas* L.							1	
6. *Columba palumbus* L.	1							
7. *Streptopelia turtur*	1	1	1	1	1	1	2	2
8. *Streptopelia decaocto* FRIV.	3							
9. *Cuculus canorus* L.				1	2	2	1	1
10. *Strix aluco* L.							1	
11. *Coracias garrulus* L.							1	
12. *Upupa epops* L.							1	
13. *Picus viridis* L.							1	1
14. *Picus canus* GM.								1
15. *Dryocopus martius* L.							1	
16. *Dendrocopus maior* L.				1	1	1	1	1
17. *Oriolus oriolus* L.		1	1	1	1	1	2	1
18. *Corvus cornix* L.						1		1
19. *Coloeus monedula* L.							2	3
20. *Pica pica* L.			1					
21. *Garrulus glandarius* L.					1	1	1	
22. *Parus maior* L.					2	3	2	1
23. *Parus coeruleus* L.						1	3	1
24. *Parus palustris* L.				1		1	1	
25. *Sitta europaea* L.							1	1
26. *Certhia brachydactyla* BREHM.							1	1
27. *Troglodites troglodites* L.							1	
28. *Turdus philomelos* BREHM.							1	
29. *Turdus merula* L.	1		1	1	1	1	1	1
30. *Luscinia megarhynchos* BREHM.		1	1	1	2	2	2	1
31. *Erithacus rubecula* L.							1	1
32. *Locustella fluviatilis* WOLF.					1		1	
33. *Sylvia atricapilla* L.		1	1	1	2	2	2	2
34. *Sylvia borin* BECHST.						1	1	
35. *Sylvia curruca* L.					1	1	1	1
36. *Phylloscopus collybita* VIEILL.				1		1	1	1
37. *Phylloscopus sibilatrix* BECHST.					1	1		1
38. *Muscicapa striata* PALL.						1	1	1
39. *Anthus trivialis* L.			1		1		1	
40. *Lanius collurio* L.				1		1		
41. *Sturnus vulgaris* L.					2	2	4	2
42. *Passer montanus* L.			1		1	2	2	
43. *Chloris chloris* L.	3						1	1
44. *Carduelis carduelis* L.			1	1		1		
45. *Fringilla coelebs* L.	1	1	1	1	1	3	2	2
46. *Emberiza citrinella* L.			1		2	2	1	1

Key to the signs used: P = pinewoods, P_c = Populeto cultum, O_{15} = 15-year old oak-forest, O_{25} = 25-year old oak-forest, O_{30} = 30-year old oak-forest, O_{50} = 50-year old oak-forest, O_{150} = 150-year old oak-forest, A = ash-forest. The numbers mean the number of nesting couples on the place of investigation.

It means that the climax bird-communities in the hardwood groves of the flood basin develop during a long time. It is possible that beside the specific branch-structure and the plantation character of the phenomenon mentioned above also

Table 2. *The diversity-values of the examined forests*

Forests	Combination of species	Distribution of fauna-elements	Category of nutrition	Nestling stratum	Global diversity
pinewoods	1.6434	1.0114	0.1519	0.6365	3.4432
Populeto cultum	1.7917	0.8675	0.6931	1.0986	4.5409
15-year old oak-forest	2.3025	1.0296	1.0296	1.3138	5.6755
25-year old oak-forest	2.4849	1.0281	0.5623	1.3086	5.3839
30-year old oak-forest	2.8861	1.0958	0.8246	1.3713	6.1778
50-year old oak-forest	3.1293	1.1889	0.9906	1.3625	6.6713
150-year old oak-forest	3.5138	1.3188	0.9413	1.2666	7.0405
ash-forest	3.1865	1.0695	0.9319	1.3150	6.5029
national average		2.0537			

justifies the examined low diversity-values. By the time the bird-community starts to develop in these "forests" the trees have already grown enough to fall them and are ready to last utilization. So on nature conservation areas where presentation is the main aim, Populeto cultum must not be used for renewal.

When I was examining the differences of bird-communities of each type of forest, the number of nesting couples per unit area in the old oak-forests and ash-forests was very high (see Table 1). It can be explained by the consideration of the revir not only horizontally but vertically, too. In a tall — 25—30 m high — robur-forest more nesting couples find possibilities for nutrition and places for hatching than in a smaller, younger stand.

The development of the bird-community starts with fauna-elements of Europe and Europe-Turkestan. Among them there are species that nest on the ground level, in the shrub stratum and in the tree stratum. It is interesting because the number of palearctic species that absolutely dominate the country's avifauna is low at the beginning, and it grows only during the long-lasting development of the community. So the average that characterises Hungary is the result of a long development. So from the quantity of deviation from it we can infer the stage of development of the examined fauna. To do this I counted the diversity of the fauna-elements on each place of survey again, and compared it with the national average. (See Table 2) From this we can follow a gradual development of the fauna which goes from the beginning to the emergence. Here the beginning is represented by Populeto cultum, because their development stopped at a low level, although the stocking starts with similar species in every type of forest. On the preserved area we find that the old hardwood grove reaches the highest point of development, which is 64% of the national average. Of course it does not mean a stopped development but shows the character of the living place.

The development of bird-communities has a close connection with the creation and utilization of the nesting place. We can find four nesting strata in the forests, namely: ground: terricol, shrub: fruticicol, stem of tree: dendricol, foliage: arboricol strata. Of course at the beginning of the development of the forests there are possibilities for nesting only for terricol and fruticicol nidatories, and for arboricol species with great resistance. As the forest grows, the proportion of species nesting in different strata changes. Dendricol species appear at last, when the trees have enough size to be hollowed out. These changes can be followed easily on the examined area.

While there are no hollow-dwellers in Populeto cultum, and there are 10% of them in the 15-year old oak forest with equal distribution of the other three strata, the old hardwood groves have 47% of dendricol species. Here the other three strata — although not in equal proportions — are represented in almost the same order of magnitude (See Table 3). The shift of these proportions shows a better utilization of the given possibilities for nesting. My previous experience seems to be justified — LEGÁNY 1977 — that the settling of birds in many cases depends on the possibilities for nesting — which is missing more frequently — much more, than on the nutriment, which can be found more easily. It means that in most of the cases the minimum factor is the place for nesting which limits the size of the fauna.

Table 3. *The distibution of species found on the places of survey of the examined forests according to nesting stratum and nutriment*

	P	P_c	O_{15}	O_{25}	O_{30}	O_{50}	O_{150}	A
terricol	—	2	3	2	4	4	5	5
fruticicol	2	2	3	5	6	7	9	5
dendricol	—	—	1	2	5	7	17	11
arboricol	2	2	3	3	4	7	6	5
carnivore	—	—	—	—	—	1	2	—
insectivore	1	3	5	9	13	16	25	18
herbivore	5	3	3	3	4	5	7	5
omnivore	—	—	2	—	2	3	3	3

Key to the signs used: P = pinewoods, P_c = Populeto cultum, O_{15} = 15-year old oak forest, O_{25} = 25-year old oak-forest, O_{30} = 30-year old oak-forest, O_{50} = 50-year old oak-fores, O_{150} = 150-year old oak-forest, hardwood grove, A = ash-forest.

That is why I analysed the distribution of bird-communities according to the nutriment. I differentiated carnivores eating mainly vertebrata, insectivores eating mainly Articulata, herbivores eating plants, and omnivorous birds. Of course I know that there are no absolute trophic categories like a bird eating only insects, but there are ones that eat mainly insects. I put each species to one or another group according to this principle.

As in most of the cases — here, too — I got the absolute dominancy of insectivores (see Table 3). Most of these are small songbirds, which get their nutriment from the forest itself, so they join in the energy-flow of their place of hatching, which means that they have a great role in keeping the ecological stability of the area. These species are also important because they are completely reduced to the forest, so their preservation can be solved by the preservation and right handling of the forest, and with ensuring tranquility for them. Of course it concerns several herbivores and omnivores which are also reduced to the forest. The carnivores had the lowest value, I found them only on two areas. The reason for the significant decrease of their number is the same as for the general disappear of predatories.

Because of the apparent differences of each type of forest I counted the value of identical species — Jaccard's number — and the value of identical dominants — Reckonen's number — in order to show that the communities are really different, they are not related to each other. The results in both cases mathematically proved the previous recognition that we can follow the development of a bird-community on the basis of both the values of identical species and identical dominants. I got the same chain of relationship, which marked out the degree of relationship between the neighbouring members with the value above 45%. According to it the members follow each other like this:

Populeto cultum — 15-year old oak-forest — 25-year old oak-forest — 30-year old oak-forest — 50-year old oak-forest — ash-forest — 150-year old hardwood grove

On the basis of all counts the pinewoods were far from the other types of forests. This is shown by the diversity-values, the fauna-elements and the strata of nesting. (See Table 2, 3). So the spruce-forest is not only alien to the landscape of the flood basin of the Tisza, but also from the hatching fauna, although it gives shelter in winter. Consequently their area must not be grown,and the renewal should be with oak.

We should mention the herons living in the examined hardwood grove but not on the area of survey. This colony has been known for some decades. The author of this work examined the hatching of *Ardea cinerea* L., *Nycticorax nycticorax* L., *Egretta garzetta* L., *Ardeola ralloides* SCOP., and *Phalacrocrocorax carbo* SHAW-NODD. in 1961 (LEGÁNY 1964). In the middle of the sixties — because of still unknown reasons — every species left the colony except *Ardea cinerea* L. and settled down near Tiszaluc. Since then only the common herons have hatched here, there were 81 couples during the examined period. It is very interesting that there were no nests on oak-trees, there were only on poplars, and one nest was on an elm. (See diagram 3) I could not find an explanation of this phenomenon, because they could have nested on oak-trees under the same circumstances, but they did not. Besides it was the same in 1971 in Marót-zug of Tiszabercel — LEGÁNY 1975 — where the 50 couples of *Ardea cinerea* L., and the 8 couples of *Egretta garzetta* L. nested on the 11 poplars of a 1-hectare oak-forest. This phenomenon must have such reason of biology of incubation that needs further examination.

Besides the colony of herons live in absolute tranquility and safety. There is only one problem of their preservation: the birds go far from their area for feed. They often visit the fish-ponds nearby, where the fall victim to the fisheries officials' allowed motion-away. The colony however has had the same size for years, so there is no significant loss of them.

To sum up the experiences we can state the following:

1. The development of the bird-communities typical of the hardwood groves of the flood basin is the result of a long process. The community is characterized by the dominancy of small insectivorous song-birds. The proportion of carnivores representing top-predatories is very low. During the development the hollow-dwellers grew is proportion and in significance.

2. On the examined flood basin the old hardwood grove should be reconstructed without last utilization and without endangering the existence of the extremely rich bird-community. Sylviculture must not be introduced here.

3. In the oak-forests planted during the renewal of forests sylviculture is allowed but as regards last utilization, consultation with experts on nature conservation is needed.

4. In case of last utilization of Populeto cultum and spruce-forests the renewal should happen with robur.

5. If we keep to the rules mentioned above, we can expect natural forests and bird-communities, and this is the first aim of nature conservation here.

References

BALOGH, J. J1958): Lebensgemeinschaften der Landtiere. — Berlin.
LEGÉNY, A. (1944): Information on Bird Fauna of the Upper Reaches of the Mid-Tisza. — Opusc. Zool. Budapest, *1*, 77—82.
LEGÁNY, A. (1965): Information on the Avifauna of the Upper Region of the Mid-Tisza. — Opusc. Zool. Budapest, *2*, 197—198.
LEGÁNY, A. (1975): A fészkelő madárközösségek szerepe a Felső-Tisza árterének biotópjaiban (The Role of Nesting Bird-communities in the Biotopes of the Flood Basin of the Upper-Tisza). — Dissertation for Candidacy. Manuscript.
LEGÁNY, A., VÉRTES IMRÉNÉ (1977): Egy modellként választott erdő madáregyütteseinek kutatási eredményei (The Results of the Examination of the Bird-communities of a Forest Chosen as Model). — Állattani Közl. *44*, 1—4. p. 115—127.
WILSON, E. O., BOSSERT, W. H. (1981): Bevezetés a populáció-biológiába (An Introduction to Population Biology). — Budapest.

A "Tiszadobi-ártér" természetvédelmi terület erdőinek madártani vizsgálata

LEGÁNY A.
Természetvédelmi Felügyelőség, Tiszavasvári, Magyarország

Kivonat

A szerző a „Tiszadobi-ártér" természetvédelmi terület erdőinek madáregyütteseit vizsgálta olyan céllal, hogy a természetvédelmi kezelés számára hasznos tanácsokat tudjon adni. Az összehasonlító elemzések során a következőket állapította meg.

1. A terület keményfa-ligeteire jellemző madáregyüttes kialakulása hosszú folyamat eredménye. Az együttesre jellemző a kistestű, rovarevő énekesek dominanciája. A csúcsragadozókat képviselő húsevők aránya igen alacsony. A fejlődés során jelentősen megnő az odúlakók aránya és jelentősége.

2. A vizsgált ártéren az ősi keményfa-liget erdőfolt fokozatos rekonstrukciója válik szükségessé anélkül, hogy véghasználatot hajtanának végre és a benne levő rendkívül gazdag madáregyüttes létét veszélyeztetnénk.

3. Az erdőfelújítások során létesített tölgyesekben az erdőgazdálkodás megengedhető, de a véghasználatoknál konzultálni kell a természetvédelem szakembereivel.

4. A nemesnyárasok és lucfenyvesek véghasználata esetén a felújítást kocsányos tölggyel kell végezni.

5. A fenti szabályok betartása mellett természetközeli erdőkre és madáregyüttesekre számíthatunk, amely a természetvédelemnek itt elsődleges célja.

Ornitološka osmatranja u šumama zaštićenog okruga plavnog područja Tiszadob

LEGÁNY A.
Inspektorat za zaštitu prirode, Tiszavasvári, Hungaria

Abstract

Autor je na plavnom području Tiszadob u šumama zaštićerog okruga vršio ornitološka istraživanja u cilju unapredjivanja zaštite prirode. Uporednom analizom utvrdjeno je sledeće:

1. Formiranje ornitofaune u tvrdolišćarskim sastojinama je dugotrajan proces. U ovim zajednicama dominiraju korisne ptice pevačice. Ptice grabljivice na vrhu piramide su slabo zastupljene. U toku razvoja dolazi do značajnog povećavanja proporcije i uloge dupljarica.

2. Rekonstrukciju mestimično prisutnih stoletnih tvrdoličćarskih sastojina postepeno treba realizovati, kako nebi ugrozili njihovu veoma bogatu ornitofaunu.

3. Privredna delatnost u obnovljenim hrastovim šumama je dopuštena, ali je pri eksploataciji obavezna konsultacija stručnjaka iz oblasti zaštite prirode.

4. Obnova plantažnih topola i četinara nakon njihove seče treba da se vrši Quercus robur-om.

5. Pridržavajući se gornjih pravila očekuje se uspostavljenje autohtonih šumskih zajednica i svojstvene ornitofaune, kao prevashodni cilj zaštite prirode na ovom području.

ИССЛЕДОВАНИЕ ПТИЦ ЛЕСОВ ПРИРОДНОГО ЗАКАЗНИКА «ТИСАДОБСКОЙ-ПОЙМЫ»

А. Легань

Инспекция охраны природы, Тисавошвар, ВНР

Резюме

Автор провел исследование птиц лесов заказника «Тисадобской поймы» с целью, разрал бот атьполезные мероприятия для охраны природы, и путем сравнительного анализа пришекзаключению:

1. В широколиственных лесах этой территории формирование птичьего общества является длительным процесом. Для данного ансамбля птиц характерны здесь мелкие размеры тела, насекомоядность, с поющей доминанцией. Хищники среди них находятся в очень малом количестве. В процессе развития, в значительном количестве возрастают соотношения и значение дуплогнезниковых птиц.

2. В изучаемой пойме растут широколиственные леса, которые нуждаются В постепенной реконструкции в такой форме, чтобы не повредить имеющегося здесь богатсва орнитофауны. Здесь и в дальнейшем не советуют вести лесное хозяйство.

3. При восстановительных лесных мероприятиях культивация дубров может быть допустима, однако не без консультации со стороны специалистов охраны природы.

4. Возобновление тополевых и еловых лесов следует провести через черещатый дуб.

5. Рядом с вышеприведенными мероприятиями, со стороны охраны природы, следует обратить осбое внимание на птичий ансамбль проживающий в аборигенных лесах.

Tiscia (Szeged) Vol. XVIII, pp. 133—144 (1983)

FROM THE LIFE OF TISZA-RESEARCH WORKING COMMITTEE TISZA-RESEARCH CONFERENCE XII (1981)

Compiled by

GY. BODROGKÖZY

Departmen of Botany, Attila József University, Szeged, Hungary

XII. Annual Tisza-Research conference was held on 24—25 April 1981 in the meeting hall of the Water Economy Management of the Low-Tisza region. Except for the Hungarian participants some members of the Yugoslavian research team were present and delivered lectures.

After the president's address dr. I. VÁGÁS greeted the participants in the name of the Water Economy Management. He highly appreciated the importance of the Water Economy Management. He highly appreciated the importance of theoretical and practical cooperations of Tisza-research, and as one of the hosts wished successful and useful work to the participants of the conference.

This was followed by informations about the results of Tisza-research in 1980 delivered by GY. CSIZMAZIA.

Lectures followed by active discussions were divided into two topics. Finally the lectures answered the questions and reacted upon the additional and critical remarks.

1. topic

General and hydrobiological investigations into the water-system of the river Tisza

VÉGVÁRI, P.:

Effect of Eger and Laskó streams on the water-quality of the Kisköre reservoir

High bank, bordering the right riverside of Tisza from the upper end of "Kisköre" reservoir up to the middle of "Sarudi rét", had an important role in rising of different water quality. The "Abádszalóki" bay was filled up mainly by Tisza water, while the greatest part of the reservoir's water came from Eger and Laskó streams with worse water guality from chemical, biological and hygenic view-points. As a result of this, in some places the actual trofity level was about the benotic hypertroph.

Irrigating chanels were constructed by opening the high bank which has significantly changed the hydrological conditions and the water quality in the reservoir. Undesired effect of the streams has been decreased significantly and the macro-vegetation spreading has been stopped.

Rinsing through the different bays with fresh Tisza water resulted in certain oligotrophization and in the decrease of salt-content.

Generally significant improvement of water quality has occured in the area. The effect of Eger and Laskó streams exerted on the reservoir has decreased. It would be advisable — first of all from hygenic view-point — to drain the edbadly polluti water of the two streams, using the inner water drainage system, into the Tisza south of the "Kisköre" reservoir.

GYŐRI, ZS.:

Physical and chemical characters of the water of the streams of Eger and Laskó

Eger and Laskó, being two small streams of the Western part of Upper-Northern mountain area are situated between the mountains of Bükk and Mátra, the former having its source from a spring of limnokren type and the later from that of helokren type.

The water guality of Eger stream is determined except its chemical characteristics first of all by the effects of the area's industrial and agricultural plants' and communal pollution. Laskó stream crosses an area with scarcer populations, so its water is less polluted with organic materials.

Our investigations recorded the present water quality conditions, stating that those of both streams are significantly worse than that of the river Tisza according to chemical parameters.

KERESZTES, T., MÁRFAI, L. and JÁSZ, T.:

Loading possibilities of the region of the river Tisza managed by the water economy management "ATIVIZIG" (1971—1978)

Loading possibility is a question of a given place or region. As a data of water quality it is the product of multiplication of the end-concentration and the characteristic mass of water resulting in g/sec.; that end-value which occure after the inflow of contamined water (after mixing the contamined water with the receptor's one) without the receptor's damage. Its investigation has special importance because financial factors require the study of natural processes, that is the recipient's "tolerance" and self-purification capacity because they determine the necessity of the establishment of the often rather expensive artifical sewage farms.

Data characterising best of all the quality of water loaded with domestic and organic industrial sewage are those of oxygen-economy, the most significant of which is the amount of dissolved oxygen and the connected oxygen saturation.

Present paper describes the loading possibilities of the Tisza region between the inhabited places "Csongrád" and "Tiszasziget" from 1971 to 1978 during 5 floodless years. Data were analyzed with computer programming.

MÉSZÁROS, M., K. BALOGH, I. and SZÉLL, J.:

Investigation of the effect of irrigation water polluted with chlore-bromuron in pre- and postemergent treatments

Urea-type herbicides interact in the second light period of the photosynthesis at postemergent treatment. This effect is followed by some other secondary effects. The photo-induced electron transport and the connected phosphorelations are being inhibited; the basic electrontransport and the non-cyclic one are being inhibited as well with water being electrodonor and $NADP^+$ or pherricianid as electroreceptor (Hill-reaction). The chlore-bromuron interacts on several points of the pathway connected with the second light period.

In our experiments the herbicide effect was investigated simultaneously with sawing in pre- and postemergent treatments. Experiments were carried out with cucumber-, barely-, rye- and oat seedlings in laboratory and field experiments in culture pots. The catalaze and peroxidaze activity, the changes in total protein content, the changes of total ascorbic-acid and phenol contents, the increase of dry-weight and growth were measured.

SZÉLL, J., BALOGH, I. and MÉSZÁROS, M.:

Herbicide mixture's action in wet and dry conditions

Effect of broumphenoxim, therbutylazim and glyphosat mixture was investigated in laboratory and field experiments in culture pots. Herbicides like these and their analogues are oxidative phosphorilation uncouplers with broum being the most potent substituent. This mixture damages metabolysm in many places. It may cause growth disturbances, even may kill the plant. That's why it is not easy to establish the concentration proper for weed-killing but not harmful for cultured plants. According to our observations the preemergent treatment didn't damage the test plants if herbicides were mixed with suitable amount of water, while the same concentrations used postemergently didn't kill the plant.

In our field experiments carried out in culture pots both the pre- and postemergently dosed concentrations killed the plants. During the experiment the natural moisture was negligable, so it could have been established that the activity of herbicides could be detected for about 62 days.

BALOGH, I., KISS, J. and FÜGEDI, K.:

Effect or irrigation water polluted with herbicide and engine-oil on cucumber seedlings

(This paper will be published in the Tiscia for 1983.)

HEGEDÜS, M., LANTOS, J. and ZSIGÓ, M.:

Some results on the antibiotic resistance of E. coli and Salmonella strains isolated from surface waters

In connection with water pollution often has been raised abroad the problem of transferable resistance (R plasmid) of E. coli and coliform strains occuring in domestic and hospital sewages and in the rivers.

In Hungary according to our informations, this kind of investigations were carried out only in the Danube river. In the station of Public Hygiene and Epidemics of County Csongrád during the past two years frequent investigations recorded the resistance of E. coli and *Salmonella bacteria* isolated from surface waters. According to the results 40—60% of E. coli strains were resistent while *Salmonella bacteriae* were highly sensitive to examined antibiotics.

The aim of our investigations and this lecture is to call the attention to the widespreading of R plasmids as possible risk factor in our rivers, the number of which is constantly increased by the ever-increasing sewage inflow.

ESTÓK, B.:

Bacteriological status of the Eger and Laskó streams

Eger and Laskó streams take their source and flow into the "Kisköre" reservoir in the territory of County Heves. Laskó crosses scarcely populated habitations, consequently it contains less organic sewage and epidemic bacteriae than Eger. The later is more polluted (differently treated domestic and industrial sewages). The other source of pollution is illegal sewage outlets in the area of Eger and the intensive animal husbandry along the reach between Szihalom and Négyes. Worst is the stream's bacteriological condition in the area of Almár—Nagytálya—Szilhalom. From the view-point of chemical data Eger stream is more polluted than Tisza. As far as Salmonella content is concerned in the water of Tisza this epidemic bacterium could have been registered only in 33.7% along the reach between Cigánd and Kisköre, while samples of Eger showed 42.8% positivity immediately at the inlet into "Kisköre" reservoir unanimously spoiling the bacteriological status of the reservoir. Consequently when considering the sport, holidaymaking, agricultural and other water-consumption possibilities the bacteriological status must be taken into account all over the area of the reservoir aspecially at the mouth of the Eger stream.

KISS, I.:

Problems of algal indicators and water classification in the environment protection of the river Tisza and its tributaries

In several cases existence of physiological variants of alga species, the so called biotypes has been observed. That's why introduction of physiologic and genetic experiments are necessary for the analysis of the four main indicators of water quality with the help of algae. In the case of halobity it is doubtful even at an osmotically non-damaged organism whether it has strong halophity or it is to be considered only as a halotolerant. As enzyme activity is significantly effected by pH, the role of it must be stressed (probably using the term of ionity or hydrogen-ionity) together with salinity.

Saprobity and trofity are connected not only by the mineralization but also by the heterothoph nutrition of certain algae. Several of them have al strong auxotrophic character being able to use up and incorporate the amino acids of the water-polluting proteins, many of them in subkingdom Euglenophyta demand the auxin; several of them or their varieties seemed to be dependent from vitamin C. Consequently polluting organic material needn't always be mineralized. Some algae change their morphology according to toxicity. All the alga bioecenosis should be more taken into account for indication. The influence of tributaries should be "experimentaly" investigated as well from the view-point of algae bioecenosis of the river Tisza.

HAMAR, J.:

Algologic data of the Eger and Laskó streams

The streams' algologic community is fundamentally influenced by pollution considerably selecting their microflora. Consequently the species found indicate these pollutions. So suitable to the amount of food supply planctonic community can not develop and algologic composition becomes homogenous.

Based on the appearance of organisms indicating pollution the water quality of the stream Eger is worse than that of the other stream, consequently it has a more significant influence on "Kisköre" reservoir.

KISS, K.:

Characteristic phitoplancton groups along the river Tisza and the Eatern Mainn channel

When examining the planctonic algae of the Eastern Main channel it was striking that quantitative relations of phytoplanctons significantly differed from one another not only during some successive years but within a year as well. Concerning quantitative relations totally different planctonalga groups appear even within some weeks. Logically rises the question whether Tisza and the Eastern Main channel do have their "own" phitoplanctonic group(s) characteristic for them periodically.

In order to answer this question constance values (K) of species found in samples were examined using the data of KÁRPÁTI Z.-TERPÓ's handbook (1971). Samples taken from the same site in different periods were considered as characteristic for the same stock, and the different samples were compared (for example the species occuring in the 80—100% of the samples of a given period was considered as that with 5. constancy).

It can be stated according to the samples' analysis that phytoplanctonic groups in the dammed up water at "Tiszalök" and those in the Eastern Main channel can be included into the same type during the development of mass-vegetation, that can be characterized by the constant presence of Stephanodiscus hantzschii and the species of Chlorococcales in great quantity. Certain subtypes of this mass-vegetation type are to be observed as well.

WAIJANDT, J. and BANCSI, I.:

Material-flow investigations in the area of Szolnok

Along the Middle-region of the river Tisza in the area of Szolnok 19 times were carried out water-delivery and cross-section material flow investigations relating to 6 components (total quantity of floating material, acetic permanganetic oxygen demand, conductivity, ammonium-ion, nitrate-ion, solved o-phosphat-ion). The flow of each component was calculated using the speed of flow and the concentration data of samples taken in 9 vertical rates by 1 or 2 meters.

The methods of calculations are as follows:

— using all the concentraion data of vertical rates and the actual speed of flow;
— using the average concentration data of vertical rates and the water output;
— using average concentration data and water output of the whole segment;
— using concentration data of the current-line and the water output of the segment.

Different methods of calculating material-flow and the comparison of data aimed to determine the minimal sample number and concentration the determination of which would still provide authentic average material-flow data.

Connection between the material-flow of 6 components and the water output was examined as well.

GÁL, D.:

Comparative zooplancton investigations in the dead reach of the river Tisza

Qualitative and quantitative changes in the zooplancton of the 5 most important dead reaches of the Lower-Tisza region (Atka, Körtvélyes, Mártély, Alpár, Tiszaug) were investigated monthly during the last two years.

Regarding both species and individual numbers Rotarita species were dominant in the zooplancton of the investigated dead branches. Brachious species were the most frequent in all 5 dead reaches. The total individual number shows two annual maxima in May and September. During maxima the total individual number is as many as 80—85 000 ind./l, and during minima — especially in winter — it varyes between 6—8.000 ind./l.

Saphrobiological quality of the water of the investigated dead branches differs significantly also showing great changes all over the year. Dominating species of the winter months are oligo-, beta- and beta-mezosaprob species (o—b.: 38—45%, b.: 35—40%, b—a.: 13—18%). During summer months water-quality gradually decays and the number of beta-, alfa-mezosaprob organisms increases (o—b.: 22—24%, B.: 36—41%, b—a.: 39—45%).

Regarding pollution of the investigated dead reaches their order is: 1. Mártély-, (most polluted), 2. Tiszaug-, 3. Alpár-, 4. Körtvélyes-, 5. Atka dead reaches (less polluted).

MELANIJA, OBRADOVIĆ, BOŽA, P. and RUZENKA DURCJANSKI:

Data to the flora of the southern Tisza region

This paper includes the data on four plants having a significant role from the view-points of plant geography and floristics in the flora of the Southern Tisza region.

Alyssum linifolium is a boreal relic species found first on the post-glacial age along the Southern Tisza region. It seems to be a differentiating species on the Pannon Plain stretching to North as far as Titel plateau.

Vicia picta FISCH. et MEY. is a Pontian species. Its appearance was mentioned in the Southern Tisza region at Beodra by KOVÁCS referring to Thaissz. KOVÁCS himself found it at Óbecse in the inundation areas of Tisza in 1914. It is to be found in Hungary, Roumania, the Southern part of the USSR and Siberia. It is a rear plant *from floristic view-point,* though nowadays it is spreading. Its plant-geographical importance is determined by the fact that its area's south-west border can be found along the Southern Tisza region.

Linaria Kociannovichii ASCHERS. This plant was described by Ascherson as the hybrid of *Linaria genistifolia* (L.) MILL and *Linaria vulgaris* MILL. Recent authors, like JÁVORKA included it into the subcategory of *Linaria angustissima* (LOIS.) BORB., or considered like Soó as a separate species. It is to be found in the European flora only in Hungary and Roumania. It is rare along the Southern Tisza region according to our investigations.

Ceratostigma plumbaginoides BUNGE is a bedding plant of Chinese origin that runs wild. It isn't mentioned either in the floae of Balkán paeninsula, Serbia or Croatia or in the weed flora of Yugoslavia.

All the four plants are important members of the flora of Souther Tisza region.

MÓCZÁR, L. and GYŐRFFY, GY.:

Quantitative and qualitative data on the flying insect communities on the "Körtvélyes" inundation area

On the moor-meadow of "Körtvélyes" island about 8200 insects were collected eith Malaise-trap in 7 periods (46 days) between 1972—1975. Hymenoptera, Lepidoptera, Coleoptera and Cicadinea groups were analysed from the stand-point of species diversity, species dominancy and species distribution, in summer, spring and autumn. We compared not only the data of seasons but those of the faunas of different living areas (saline area of Dorozsma, "Ásotthalom" forest). On the basis of these we established the following:

1. The ratio of Diptera order increased from spring to autumn from 53% to 86%. Subdominant Hymenoptera (11%) was followed by Cicadinea (6%) and Lepidoptera (6%).
2. Living-area specificity of the Hymenoptera was the greatest, that of Cicadinea was medium and Lepidoptera and Coleoptera were much less specific.
3. According to the Hymenoptera, Coleoptera and Cicadinea faunas the moor-meadow differs most from saline, quality of Lepidoptera fauna of these shows the gratest similarity.
4. Considering aspects the greatest similarity can be observed between the spring and summer Hymenoptera and Lepidoptera faunas (17 resp. 24%) while the autumn fauna differs most of all. Majority of Cicadinea spring and summer populations is represented by the species diversing in time. The greatest part of autumn fauna is to be found in summer too.
5. Hymenoptera diversity is the highest caused by the great species number. Diversity of Lepidoptera increases paralell with the biotop's diversity, while that of Cicadinea the greatest is on the lawns because of the greater evenness. Evenness of Coleoptera populations of different areas is nearly the same.

GALLÉ, L., GYŐRFFY, GY. and H. HORNUNG, ERZSÉBET:

The flood-wawe as oecological perturbation

There are few quantitative data in the literature of the Tisza investigation dealing with the effects of floods on the structure of epigenic animal populations. That's why the authors' assumptions based on these data have the character of working hypothesis:

1. Disaster theory is the suitable model for studying the floods' oecological consequences. The speed of inundation, its height and length have important effect in the forming of jumpings type "fold" disaster and in the measure of hysteresis and in the time of jumpings. Possibilities of appearance of the "cusp"-type disaster are decided by the number of refugees.

2. The recolonisation from other areas consists of two phases:

(a) in the immigration phase the number of initiation population is saturative and

(b) in the phase of multiplication it has logistic increase. Forming of these two phases and their ratio depend on the migrative inclination of the recolonizing populations and on the strategy of their multiplication.

FARKAS, Á.:

Effect of the Tisza floods in 1980 on the multiplication of some fish-species

Frequent and long floodsof 1980 year effected properly the spawning of the most fish-species.

Inundation area was covered with water almost constantly from February till the end of June. There were inundations of greater degree in the middle of February and March, at the end of April and at the beginning of June, August and December.

The warm water of the inundation area provided suitable possibilities for lyaing roes and food for young and their majority got back into the river with the reentry of the flood.

During the flood of February and March happened the spawning of pike and during the flood at the end of April that of pike-perch and that of the carp and the silure in June. The great quantity of young proves the successfull spawning.

BÁBA, K.:

Effect of the land areas of the Tisza plain on the forming of snail fauna

(Lecture will be published in the volume of Tiscia for 1983.)

LŐRINCZ, J.:

The winter-feeding of osperies in the reservation area of the middle-Tisza region

We began to feed osperies in "Pélyi" Bird reservation area in winter 1976—77. The first years provided only an indirect proof of success lacking proper experiences. In 1978 the coast of feeding was provided by the Direction of "Hortobágy" reservation area. In February of 1978 we could provide direct observations. At that time feeding place was frequented by 9 osperies and one young golden-eagle. Feeding has become regular since then and on the basis of present results and experiences a nation-wide movement is developing.

CZIZMAZIA, GY.:

Migratory dinamism of micromammals along the Tisza damn

(Lecture will be published in the volume of Tiscia for 1983.)

HALASY, KATALIN and CSOKNYA, MÁRIA:

Structure and functioning of the post-intestine of anisoptera larvae

In the case on Anisoptera larvae post-intestine modifies into intestine-branchia taking part in the breathing as well. Anatomically it can be divided into ileum and rectum of three-fold division (the proper rectum, breathing chamber and atrium).

Water necessary for respiration gets thourh the analis pyramid into the breathing chamber the inner part of which is covered with gill-laminae. This is the place of breathing. The epithel of the intestine forms the gill-laminae. Epithel-cells may be cylindric or cubic and finally flat. They are poor in organellum and their surface is covered with thin cuticula.

TÖLGYESI, GY. and KOZMA, A.:

Taxonomic and oecological data on the microelement concentration of the plants of Tisza, Kisköre and Abádszalók inundation areas

Significant phytocenological and oecological changes in the native vegetation of the inundation areas of the Middle-Tisza region and those of Kisköre—Abádszalók—Pusztataksony have frequently been stated since the completition of the barrage Tisza 11. caused by the Reservoir of 124 km² territory and by daming the water of the river up the direction of Tiszalök. Filling up the reservoir resulted in the destruction of soft-wood gallery-forest and their undergrowth over extended areas of the inundation plain on both sides of the river. Extended water cover results in new plant-associations. As a consequence of building of the reservoir and redamning the river significant changes occured both in vegetation and the soil from hydrological stand-points. This lecture points out some taxonomic and oecological changes of the area's vegetation on the basis of our examinations in 1980. Some of them are characterised briefly as follows:

1. Species of Graminae, Cyperaceae and Typhaceae families — investigated in the area — significantly differ chemotoxonomically from the dicotyledons with their small Ca, Mg, Cu and B content.

2. Na, as a macroelement and Mn as a microelement of the area's vegetation are especially suitable for the illustration of the differences between the monocotyledonous Graminae and Cyperaceae regarding these elements. According to our experiences plants with high mangan content have significant quantity of natrium as well. This can be explained by the reductive milieu of the firmly hydrofil soil of the inundation areas.

3. Investigated plants of the Tisza inundation areas on the whole and especially those of the area of Kisköre—Abádszalók show the significant ability of zinc-accumulation. At Abádszalók it is 77.8 ppm that is twice as much as the Hungarian

average (33.9 ppm). Because of its ideal mineral content and great quantity the vegetation of Kisköre—Abádszalók inundation area should be used for feeding more intensively.

BANCSI, I.:

Investigation of the small watershed area of the middle-Tisza region

The investigation of the small watershed areas provides the increasing number of information required by the problems of water management. These informations can be obtained by the periodical and detailed control of the quality change of water carried out with analytical methods during 5—6 years. Results of the above-mentioned examinations in the watershed area of Gerje—Perje in 1980 unanimously proved this idea to be correct.

The lecture includes the general references to the investigations of the small watershed areas and some characteristic details of our results.

The data of these investigations are going to be published in a paper.

STAMMER, ARANKA and MALIK, ERZSÉBET:

Change of the construction of blood cells in the fishes of Tisza

Eight types of blood cells described by SCÄPERKLAUS (1979), LEHMAN and STÜRENBURG (1975) were examined in ten fish species of Tisza with light-microscop using Giemza and Pappenheim dying and the cytoplasmic granulates were observed with electronmycroscope.

Blood cells of the fishes belonging to different orders and ages were totally the same but they greatly differed from the higher classes of vertebratae regarding their shape, size and plazma-organs. It is difficult to separate the thrombocytae, limphocytae and granulocytae. Classification of the blood cells developing in the different sections of the kidney — the main organ of haematogenesis — is difficult.

High salt and ammonia content, increase of temperature and pH, the lack of oxigen or vitamin and the effect of pesticides or antibiotics — all these factors result in the damage of cellular membranae, hypocromasia, amitosis, increase of the number of proeritrocytae, decomposition of the red blood cells, modification of the red blood cell — limphocyta ratio and forming vacoulum in the monocytae. Usually hamatogramm of the fish was changed only by a strong environmental effect, so it can be established that the blood analysis — although it is relatively easy to carry out — doesn't offer essential proof of diseases.

TÓTH, MÁRIA and ZSUGA, KATALIN:

Biological examination of the watershed area of Gerje and Perje

The plant and animal organisms of water have a significant effect on the water-quality by means of their metabolism. That's why their biological examination is important in studying the oecosystems.

Saprobiologic, bacteriologic, algalogic, chlorophyll content and zooplancton analysis were carried out in the watershed area of Gerje and Perje between February and November of 1980. These data showed that the water-qualities of Gerje and Perje main channels significantly differ.

Bacterioplancton of the tributaries of Gerje main channel is rare, because of its poor nutrient content, the mass of photosyntetic pigments is small. Its alga flora is characteristic for clear waters, its special composition is various. Planctonic and bentic elements are mixed up in its zooplankton, it is populated with organisms characteristic for waters containing little organic material.

The water of Perje main channel is much more polluted, its bacterium content changes extremely seasonally depending on the sewage-inflow. Its chlorophyll content indicates eutroph-hypertroph relations ant high nutrient content. Seasonally occuring enormous mass of algae is represented by *Euglena* genus. Its zooplanctonic organisms are characteristic for polluted water, their quantity sporadically is enormous.

The data of biological experiences showed the Perje main channel to be also extremely polluted. Following the direction of current some natural clearing up can be detected but after flowin into the common Gerje—Perje main channel it causes still significant degradation of water-quality.

MOLNÁR, GY.:

Investigation into the nest colonies and nesting behaviour of the starling *(Sturnus vulgaris* L.*)* in the inundation area of the Tisza

The nesting colonies of starling play an important role in the biotops of birds nesting in the inundation area of the Tisza. The colonies develop in the hollows of willows of the inundation area after the starling's arrival at the end of March. Survey of the number of individuals and size of the nesting colonies was impossible because of the flood, so it required the application of a new method. Individuals flying out of the forest on the dam and in the adjecent agricultural areas in order to obtain food could be well followed and counted. In order to estimate the approximate number of pairs, number of starlins flying out or back to the forest in 10 minutes along the 300, 350 and 400 m long sections of dam was divided with the average time of feeding (3 minutes in the case of starlings).

If the number of flights is denoted by x, and the number of pairs by n, our estimation will be as follows:

$(x=3n)=9$ minutes, circ. 10 minutes

According to this in Tápé—Vesszős region of the Tisza inundation area 80 pairs of stralings were nestling in 4 populations. Because of the birds carry at one time some insects in their peckers to theit nestlings, and having a quick feedingrhytm the kill insects of considerable quantity. After the nestlings' maturita they are compelled with starving by their parents to leave the hollow. This procedure often goes on one day and a half. This problem is a true parent-descendant type conflict, which is hardly described.

MIKES, M., HABIJAN, V. and DIMITRIJEVIC, S.:

Oecological aspects of the wild cat's *(Felis Silvestris* SCHR., 1977*)* feeding behaviour

According to our investigations carried out along the Lower-Tisza region into the relative and frequency ratio of the wild cat's prey (HABIJAN—DIMITRIJEVIC 1979) and into the distribution of small mammals in certain biotypes and into the day-night rhytm of prey-predator can be drawn mutual and unambiguous connection. Rodents remnants found in their stomacs prove them being the main source fo the predator's food.

From faunistic stand point it is important to mention the first appearance of the forest-vole — *Cletrhrionomys glareolus* — at the Tisza, hintin at the primary forest stand of the Lower-Tisza regionon biocoenological level.

Analysing the question of "benefit" or "damage" wild cat by killing noxious rodents proved to be unanimously useful. It would be advisable to establish here a Protected area and provide the protection of the species in question.

Felelős kiadó: dr. Bodrogközy György
82-2250 — Szegedi Nyomda
Felelős vezető: Dobó József igazgató